

**TIN-PLACER SAMPLING METHODS AND RESULTS,
CAPE MOUNTAIN DISTRICT,
SEWARD PENINSULA, ALASKA**

BY JOHN J. MULLIGAN AND ROBERT L. THORNE

* * * * * **Information Circular 7878**



**UNITED STATES DEPARTMENT OF THE INTERIOR
Fred A. Seaton, Secretary
BUREAU OF MINES
Marling J. Ankeny, Director**

1959

The Library of Congress has cataloged this publication as follows:

Mulligan, John J

Tin-placer sampling methods and results, Cape Mountain district, Seward Peninsula, Alaska, by John J. Mulligan and Robert L. Thorne. (Washington, U. S. Dept. of the Interior, Bureau of Mines, 1959.

iii, 69 p. illus., maps, tables. 27 cm. (U. S. Bureau of Mines. Information circular 7878)

Bibliography : p. 69.

1. Tin mines and mining—Alaska—Seward Peninsula. 2. Tin ores—Alaska—Seward Peninsula. I. Thorne, Robert L., Joint author. II. Title. (Series)

[TN295.U4 no. 7878]

Int 59-26

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TIN-PLACER SAMPLING METHODS AND RESULTS, CAPE MOUNTAIN DISTRICT, SEWARD PENINSULA, ALASKA^{1/}

by

John J. Mulligan^{2/} and Robert L. Thorne^{3/}

SUMMARY

The creeks draining Cape Mountain, on the western tip of Seward Peninsula, Alaska, comprise the Cape Mountain tin-placer district. Because of the war-caused shortage of tin, the Bureau of Mines in 1943 conducted a churn-drill placer reconnaissance to explore the district. Favorable indications were found, and plans were made for further investigation of the deposits; the plans were abandoned when tin again became plentiful.

In July 1951 the Zenda Gold Mining Co. was granted a Defense Minerals Administration (Defense Minerals Exploration Administration after October 1951) loan to continue exploration of the more favorable areas indicated by results of the Bureau's investigation. Equipment was moved to the area in the fall and winter of 1951-52. During the 1952 field season, 209 churn-drill holes totaling 7,521 linear feet and 10 test shafts totaling 96 linear feet were sunk on the Cape Creek drainage. Work was resumed in 1953, when 86 churn-drill holes totaling 3,157 linear feet were drilled on Boulder Creek. The company planned to drill Goodwin Gulch and Goodwin Creek, but no further work was done owing to lack of capital.

Exploration of the Cape Creek drainage resulted in the discovery of a placer-tin deposit on Cape Creek above the mouth of First Chance Creek, in the buried gravels of an older channel on bedrock below the present drainage. As a result of this discovery, the Defense Minerals Exploration Administration (DMEA) issued a certificate of discovery on March 22, 1956. Deposits considerably lower in grade also were found on First Chance Creek, Cape Creek Beach, and Boulder Creek.

No additional exploration or other work has been done in the Cape Mountain placer district since 1953, except for annual assessment work on some claims.

^{1/} Work on manuscript completed December 1958.

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INTRODUCTION

The Cape Mountain placer district produced more than 500 tons of tin between 1935 and 1941 and a small quantity for many years before that time. In 1943, the Federal Bureau of Mines conducted a program of churn-drill reconnaissance sampling of the entire district to indicate possible sources of strategically important tin. Favorable areas were found during the preliminary phase of the program. Additional investigations were planned, but the project was abandoned when tin again became plentiful. The results were published.^{4/}

The Zenda Gold Mining Co. later acquired control of the placer ground in the Cape, Goodwin, and Boulder Creek drainages in the Cape Mountain placer district and in 1951 requested the assistance of the DMEA to continue exploration. A loan was granted in 1951; active exploration was begun in the spring of 1952 and continued throughout the 1952 and 1953 working seasons.

The Zenda Gold Mining Co. exploration program, based on previous reconnaissance by the Bureau of Mines, resulted in the discovery of considerable additional reserves of placer tin. The present report supplements the previous Bureau publication and gives data obtained during the DMEA-financed exploration.

ACKNOWLEDGMENTS

Acknowledgment is made to the officials of the Zenda Gold Mining Co. for making available pertinent data, especially Norman C. Stines and J. U. M. Troy, who managed the Zenda company during the period of exploration, and Ralph Lomen and Harry Gabrielson, the present owners.

Particular thanks are due the driller-foremen in charge of field work, who cooperated fully with the Bureau engineer. Jack Thiessen was driller-foreman in charge of the drilling and shaft sinking on the Cape Creek drainage during the 1952 season; Glen Adams was driller-foreman during the 1953 field season.

Acknowledgment also is made to the Geological Survey for the use of geological maps and the reports listed in the bibliography and to the Defense Minerals Exploration Administration for the use of sampling data resulting from the joint Government-operator exploration program.

LOCATION AND ACCESSIBILITY

The Cape Mountain tin-placer district, which encompasses all creeks heading on Cape Mountain, is on the western tip of the North American Continent at approximately lat. 65° 35' N. and long. 167° 59' W. The district lies within a radius of 6 miles of Wales, the nearest permanent village, and is about 110

^{4/} Heide, Harold E., and Sanford, Robert S., Churn Drilling at Cape Mountain Tin Placer Deposits, Seward Peninsula, Alaska: Bureau of Mines Rept. of Investigations 4345, 1948, 14 pp.

miles northwest of Nome, the principal city on the Seward Peninsula. Figure 1 is a map of Alaska showing where the district is located, and figures 2 and 3 are detailed maps of the district.

Wales is an Eskimo village with a population of 141 (1950 census). It includes a small trading post, a shortwave radio station, and an airfield ordinarily used only by bush planes carrying loads of 1 ton or less.

Tin City, about 5 miles southeast of Wales at the mouth of Cape Creek on the northern shore of the Bering Sea, has no civilian population but is the site of active military installations, which include an airfield suitable for use of DC-3 and similar aircraft. It has been the center of mining activity in the Cape Mountain placer district because its beaches are the most favorable places in the area for landing seaborne freight. Freight too heavy or bulky for shipment by air is either transported from Nome by tug and barge or, if the volume justifies it, lightered ashore (with the same equipment) from steamships. There are no port facilities; the barges are pushed against the beach and unloaded on the sand. Consequently, unloading is impossible when onshore winds create a heavy surf.

A gravel road, extending from the beach at Tin City to Goodwin Gulch and the head of Cape Creek, joins the new military roads that connect the various installations and the airfield. A trail, suitable for tracked vehicles, runs from the end of the gravel road at Goodwin Gulch around the north side of Cape Mountain to Boulder Creek and Wales.

The Post Office Department provides semiweekly airmail service from Nome to Tin City and Wales by a contract carrier who also transports light freight and passengers. Competing carriers make frequent unscheduled flights to the area.

Nome is the chief port-of-call for ships, the center of air traffic, and the distribution center of the Seward Peninsula. All passengers and mail and much of the freight are transported to the Seward Peninsula by air. In addition to considerable unscheduled air traffic, regularly scheduled airlines based in Fairbanks and Anchorage make daily flights into Nome. Planes ranging in size from large commercial to small bush types are available for charter. Steamships from Seattle make 2 or 3 trips per year to Nome and the Bering Sea ports. The first ship leaves Seattle about May 20 and the last about September 1. The ships are scheduled to leave the Bering Sea in early October. No ports have docks where ships can unload; all freight is lightered ashore by tugs which tow barges carrying 50 to 150 tons. The tugs and barges also are used for local coastwise shipping. They are based in Nome and accompany the ships to the other ports of call on the Seward Peninsula.

The freight rate on general cargo from Seattle, Wash., to Nome, Alaska, in 1956 was \$1.33 a cubic foot, divided as follows: Seattle wharfage and hauling, 7-3/8 cents plus a 3-percent tax; Seattle to ship anchorage, Nome, 95-1/2 cents; Nome lighterage, 30 cents. The rate per hundredweight was double the cubic-foot rate.

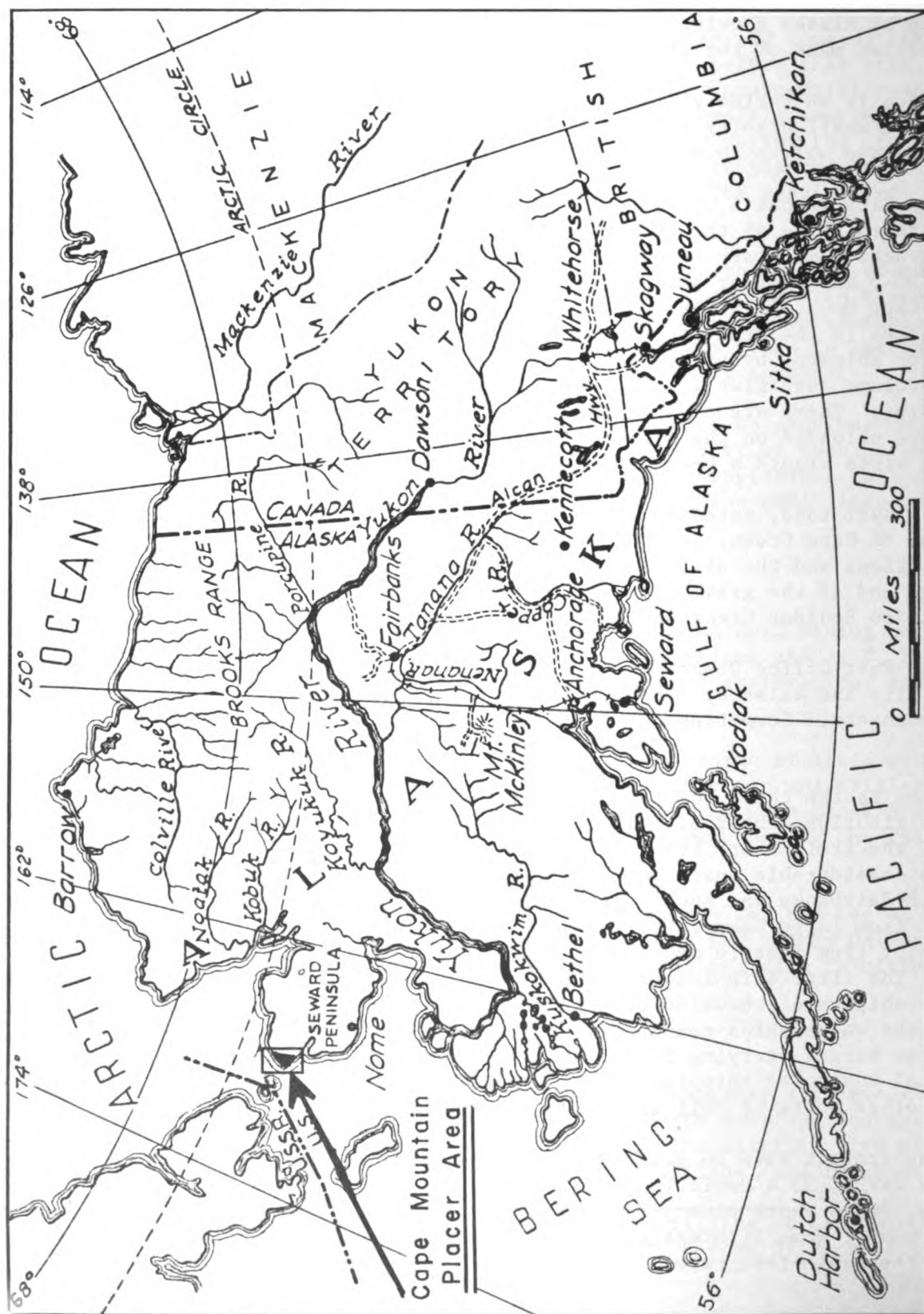


FIGURE 1. - Index Map of Alaska.

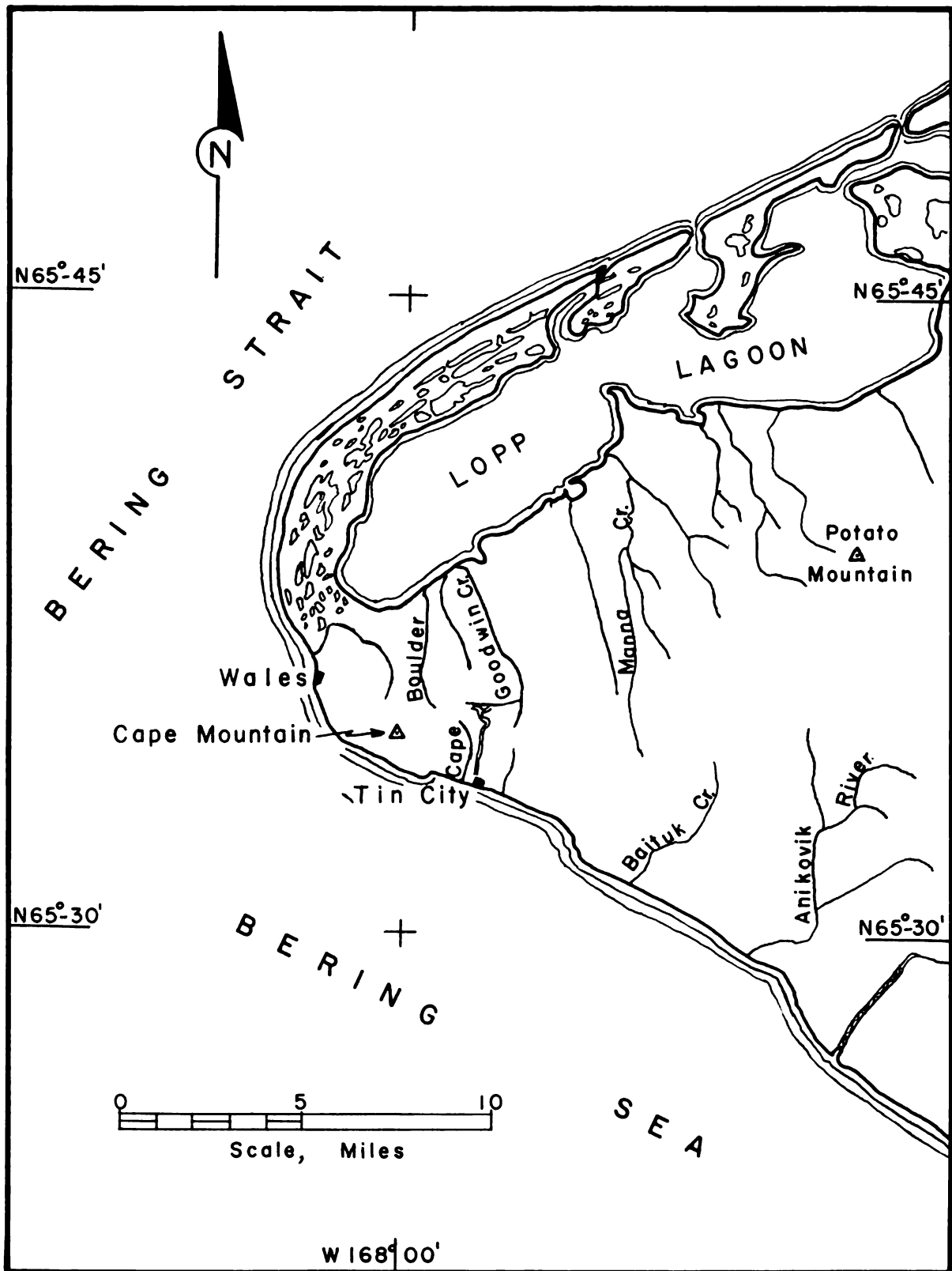


FIGURE 2. - Cape Mountain Area.

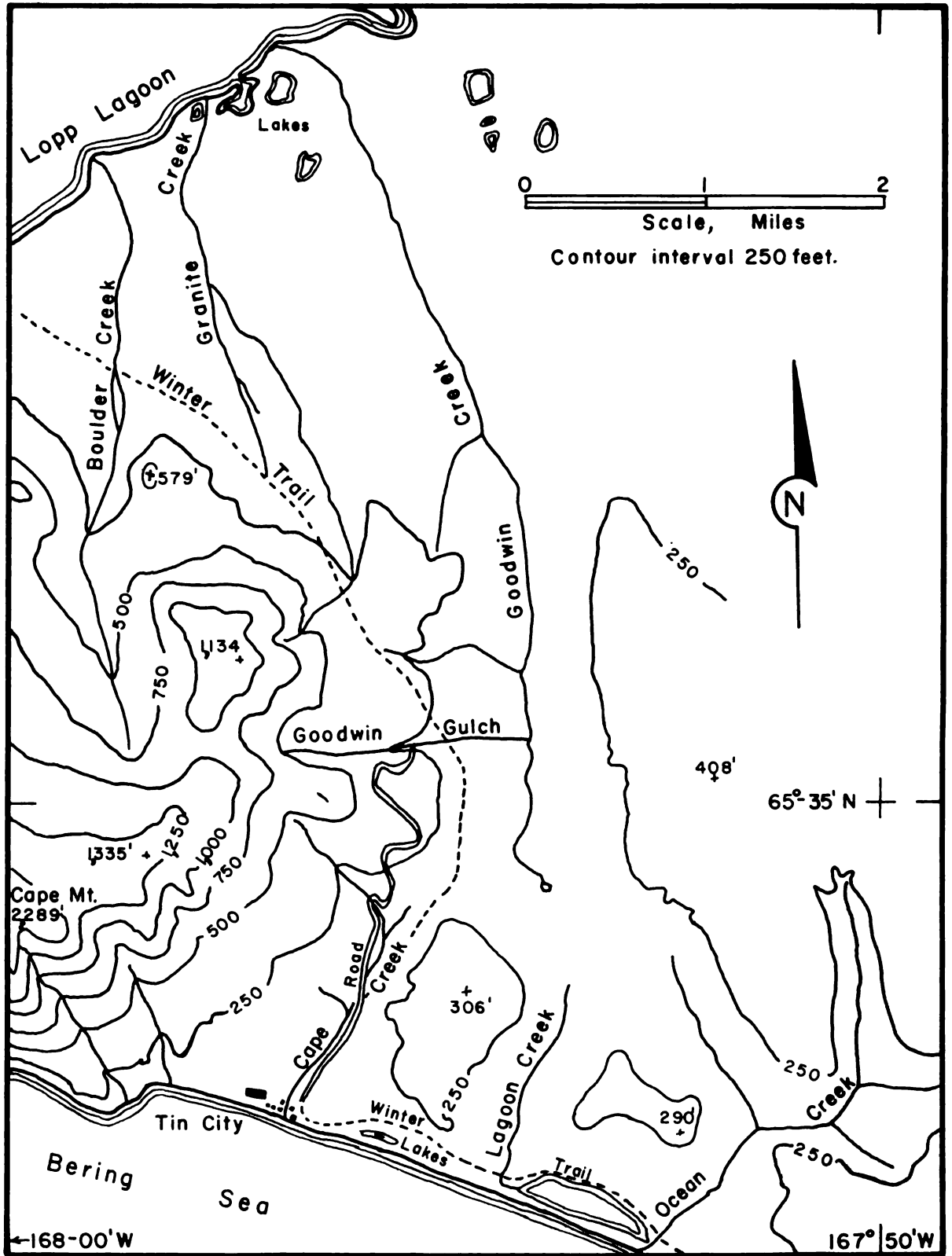


FIGURE 3. - Cape Creek-Boulder Creek Area.

HISTORY AND PRODUCTION

The first tin discovered on Cape Mountain was in lode deposits, and prospecting was confined largely to these lodes for many years. Later, placer tin aroused interest. Beginning in 1924, sporadic attempts were made to hand mine on Cape Creek and Goodwin Gulch. Records show that 133 tons of tin was produced by hand mining to 1935. In 1935 American Tinfields, Inc., began operating and by 1941 had produced 523 tons of tin. After 1941 the company ceased operations owing to supposed exhaustion of minable tin-bearing gravel on Cape Creek and Goodwin Gulch.

In 1942 and 1943 the Bureau of Mines investigated the Cape Mountain tin-placer deposits; the results of this work were published.^{5/}

In 1951 the Zenda Gold Mining Co. initiated a DMEA-financed exploration program. Actual exploration was started in the spring of 1952 and continued through the 1952 and 1953 field seasons. At the end of the 1953 season all equipment was left in readiness to resume exploration in 1954; however, for financial reasons, only assessment work, principally stripping and ditching, has been done since then.

In the spring of 1957, the Lomen Commercial Co. brought action to recover debts from Zenda Gold Mining Co., and judgment was rendered in the United States District Court at Nome, Alaska. To satisfy the judgment the properties held by the Zenda Gold Mining Co. in the Cape Mountain placer district were sold at public auction. Lomen Commercial Co. was the successful bidder.

Lomen Commercial Co. later deeded the property to Ralph Lomen and H. G. Gabrielson, who also acquired title to the property formerly leased to the Zenda Co. by Mrs. T. A. Petersen. In the fall of 1957, Lomen and Gabrielson applied for a patent through the Federal Bureau of Land Management. The application is now pending.

PHYSICAL FEATURES, CLIMATE, AND WATER SUPPLY

Five major creeks (Village, Boulder, Granite, Goodwin, and Cape) head on Cape Mountain, a prominent peak towering more than 2,300 feet above the Bering Strait. These creeks are steep at their heads, narrow, and shallow and flow only a few miles to the Bering Sea or Lopp Lagoon. Figure 2 is a map of the Cape Mountain area.

A permanently frozen mantle of detritus, ice, and organic material covers almost the entire area and, except on the steeper slopes and ridges, supports a thick growth of tundra mosses and other plants. Although limited zones may be thawed by stream action, this mantle and the stream gravels must be thawed during mining. No timber and very little brush grow in the area, but some driftwood can be obtained on the beaches.

^{5/} Work cited in footnote 4, p. 2.

The Cape Mountain area projects into Bering Strait between the Arctic Ocean and the Bering Sea; consequently, it is subject to high winds from the north or south, bringing much fog, mist, and rain during the working season. Table 1 summarizes pertinent weather data collected at Wales by the United States Weather Bureau.

TABLE 1. - Weather summary, Wales, Alaska

	Average temperature, °F.	Average precipitation, inches	Average snowfall, inches
January	0.8	0.67	10.0
February	-1.7	.83	7.5
March	-2.7	.55	6.7
April	12.8	.30	4.0
May	26.6	.43	2.5
June	38.7	.58	.2
July	46.0	1.43	.0
August	45.9	2.74	Trace
September	40.3	1.98	.7
October	30.6	1.20	5.0
November	20.0	.63	6.9
December	4.4	.64	8.2
Annual	21.8	11.98	51.7
Ice breakup, Bering Strait (average date)			June 7.
Ice freezeup, Bering Strait (average date)			1/Nov. 29.
Highest recorded temperature			75°F.
Lowest recorded temperature			-41°F.
<u>1/ Harbors freeze about 2 weeks earlier.</u>			

One chief obstacle to placer mining in the Cape Mountain area is the scarcity of water. The water supply depends upon early seasonal thaws and light rains. All creeks except Goodwin Creek have a highly fluctuating, undependable, and intermittent flow. Hand miners in the area depended entirely upon the intermittent water supply for mining. American Tinfields, Inc., hauled gravels from Cape Creek to a washing plant at Tin City; this washing plant was supplied with water pumped from the Bering Sea. Water is even more difficult to obtain and hold on Boulder Creek than on Cape Creek. Usually water can be seen in the extreme headwater tributaries, but normally the bed of Boulder Creek is dry. Water from the headwaters disappears under the coarse, uncemented gravels and presumably flows along bedrock.

LABOR

Except for supervisory personnel and specialized technicians, both skilled and unskilled labor for a placer operation can be recruited from the resident white and native population of the Seward Peninsula. The natives are Eskimos, most of whom have little education or training in mechanical trades; however, many of them have a high degree of mechanical aptitude and have had considerable experience in placer mining and construction. The Eskimos and resident white workmen usually are inured to primitive conditions

in a difficult climate and will work well under circumstances that would be considered intolerable in more developed areas.

Table 2 lists the population of settlements in the western part of the Seward Peninsula, as recorded in the 1950 census. A high percentage of the population is available for employment due to lack of other industry in the area.

TABLE 2. - Population of western part
of Seward Peninsula

Diomedes	103
Igloo	64
Nome	1,930
Shishmaref	194
Teller	140
Teller Mission	109
Wales	<u>141</u>
Total	2,681

PROPERTY AND OWNERSHIP

Claims controlled by the Zenda Gold Mining Co. during the DMEA exploration program, 1951-53, are listed as they appear on public records in the United States Commissioner's office at Nome, Alaska. Comments regarding ownership apply to that period; the present status of the various claims has not been investigated. The claims are shown in figures 4, 5, and 6 and are listed by areas under the following subheadings.

Cape Creek Claims

In the Cape Creek drainage the Zenda Gold Mining Co. controlled four groups of claims. The authors believe that most of these remained in the possession of the company and were acquired subsequently by Ralph Lomen and H. G. Gabrielson.

Boulder Creek Claims

In the Boulder Creek drainage, four claims were leased from Harry B. Palmer. When it became evident that title to these claims was not clear, Harry B. Palmer quitclaimed the group to the Zenda Gold Mining Co. These claims are not shown on the claim map but are listed below.

A group of 13 claims (including ground covered by the 4 Palmer claims) was leased from William Munz, H. W. Edwards, and Otto Worm. Otto Worm transferred his interests to the other two lessors on August 1, 1951. Advance royalties on these 13 claims were due in September 1953 and annually thereafter. The royalties were not paid, and title reverted to the owners.

The Zenda Gold Mining Co. located six additional claims on Boulder Creek.

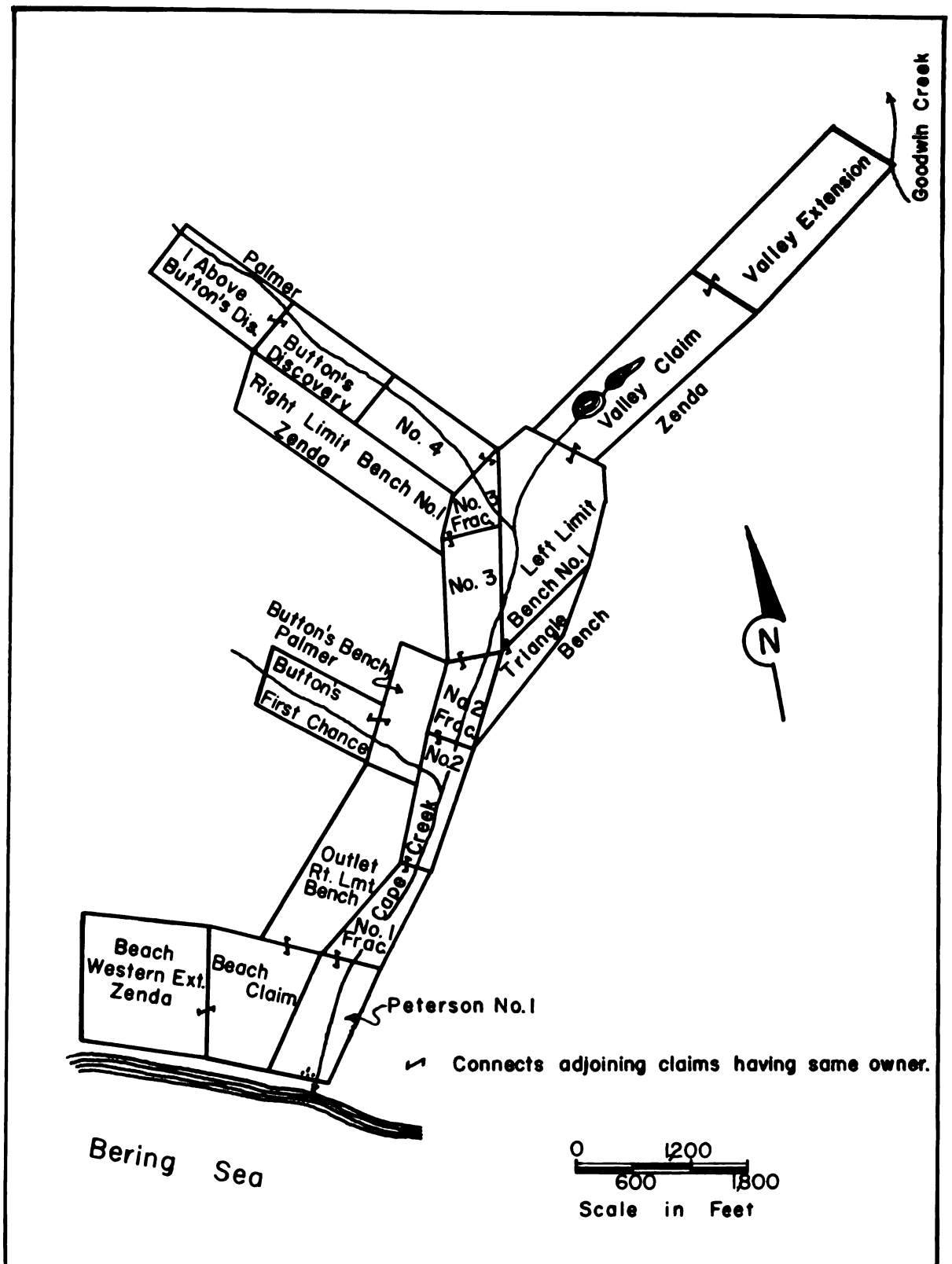


FIGURE 4. - Cape Creek Claims.

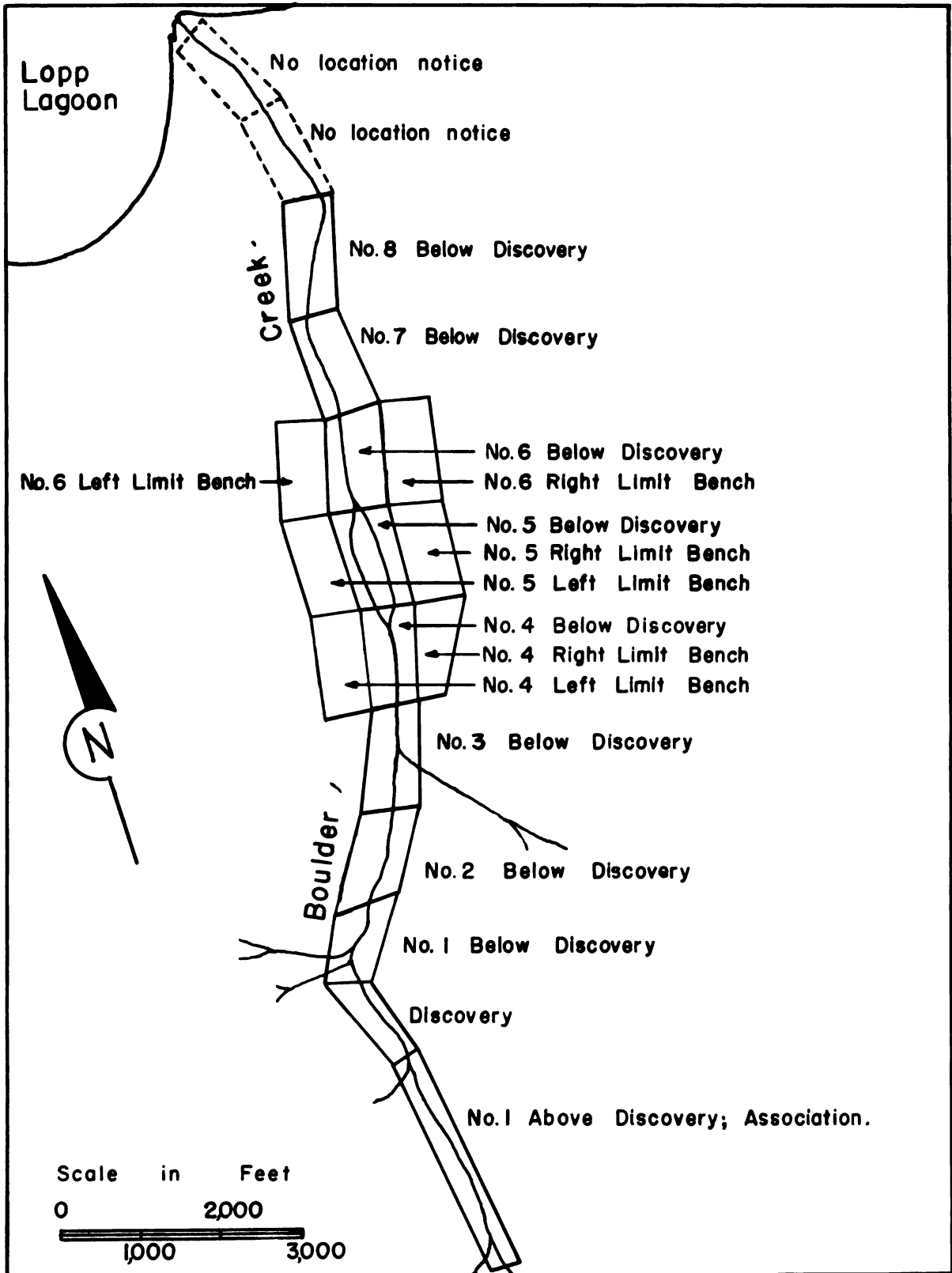


FIGURE 5. - Boulder Creek Claims.

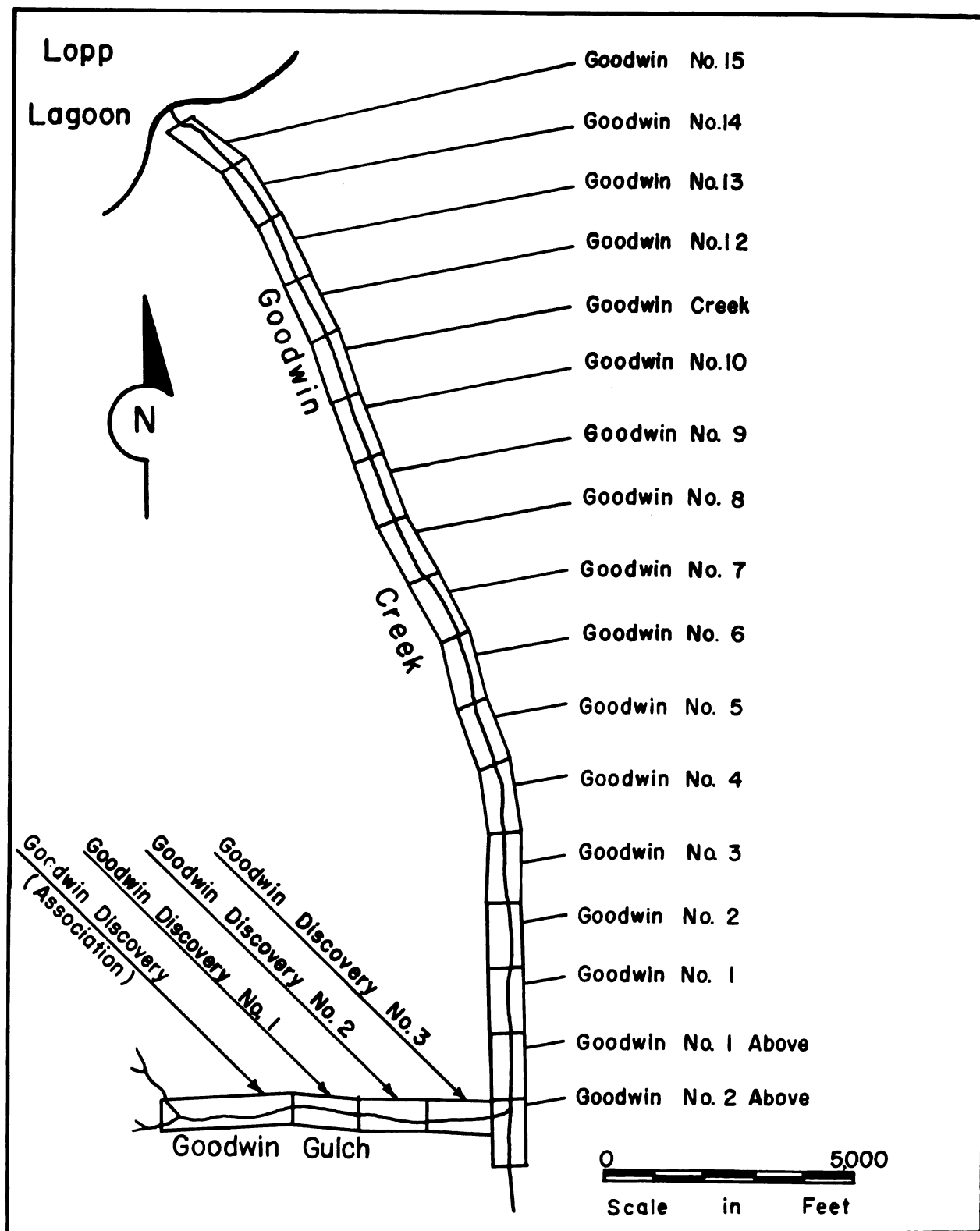


FIGURE 6. - Goodwin Creek Claims.

TABLE 3. - Cape Creek claims

<u>Claim</u>	<u>Date recorded</u>	<u>Volume</u>	<u>Page</u>
<u>Leased from A. V. Peterson:</u>			
Cape Creek No. 1 Claim	Aug. 29, 1935	100	175
Cape Creek No. 1 Fraction	do.	100	173
Cape Creek No. 2 Claim	do.	100	174
Cape Creek No. 2 Fraction	do.	100	176
Cape Creek No. 3 Claim	do.	100	177
Cape Creek No. 3 Fraction	do.	100	178
Cape Creek No. 4	do.	100	179
<u>Deeded by Harry B. Palmer in 1953:</u>			
	<u>Instrument</u>		
Button's Discovery	85364	224	154
1 Above Button's Discovery	85363	224	154
Button's Bench	85366	224	155
Button's First Chance	85365	224	155
<u>Owned by the Zenda Gold Mining Co.:</u>			
Left Limit Bench No. 1		228	201
Valley		228	202
Valley Extension		228	203
Beach		228	203
<u>Acquired by quitclaim deed from Norman C. Stines and W. H. Kirklin on Sept. 2, 1952:</u>			
Beach Western Extension			
Outlet Right Limit Bench			
Right Limit Bench No. 1			
Triangle Bench			

TABLE 4. - Boulder Creek claims

<u>Claim</u>	<u>Instrument</u>	<u>Volume</u>	<u>Page</u>
<u>Acquired by quitclaim deed from Harry B. Palmer:</u>			
Discovery	85369	224	153
1 Below Discovery	85368	224	153
2 Below Discovery	85367	224	153
1 Above Discovery	85370	224	156
<u>Acquired from Munz, Edwards, and Worm:</u>			
Discovery	87808	228	114
No. 1 Below Discovery	87809	228	115
No. 2 Below Discovery	87810	228	115
No. 1 Above Discovery	87878	228	122
No. 3 Below Discovery	87811	228	115
No. 4 Below Discovery	87812	228	115
No. 5 Below Discovery	87813	228	116
No. 6 Below Discovery	87996	228	124
No. 7 Below Discovery	87997	228	124
No. 8 Below Discovery	87998	228	124
No. 4 Above Discovery	87875	228	121
No. 3 Above Discovery	87876	228	121
No. 2 Above Discovery	87877	228	122
<u>Staked by Zenda Gold Mining Co.:</u>			
No. 4 Right Limit Bench.	No. 4 Left Limit Bench.		
No. 5 Right Limit Bench.	No. 5 Left Limit Bench.		
No. 6 Right Limit Bench.	No. 6 Left Limit Bench.		

Goodwin Creek-Goodwin Gulch Claims

In the Goodwin Creek-Goodwin Gulch drainage the Zenda Gold Mining Co. leased 21 claims from B. E. Douglas, Allen G. Doyle, Theodore C. Duffield, H. W. Edwards, Charles F. Goedde, and Robert H. Renshaw. No work was done on the ground. The Zenda Gold Mining Co. failed to pay the advance royalties when due; therefore, the owners declared a forfeiture. The DMEA-financed drilling on Cape and Boulder Creeks resulted in a Certification of Discovery. The terms of the contract were such that these claims are included in the resulting obligation to repay the exploration costs, although the Zenda Gold Mining Co. no longer owns them.

TABLE 5. - Goodwin Creek-Goodwin Gulch claims

	<u>Claim</u>	<u>Instrument</u>	<u>Volume</u>	<u>Page</u>
Goodwin No. 1		87830	228	116
Goodwin No. 2		87831	228	116
Goodwin No. 3		87832	228	117
Goodwin No. 4		87833	228	117
Goodwin No. 5		87834	228	117
Goodwin No. 6		87835	228	117
Goodwin Discovery		87879	228	119
Goodwin No. 7		87880	228	119
Goodwin No. 8		87881	228	119
Goodwin No. 1 Above		88028	228	127
Goodwin No. 2 Above		88030	228	127
Goodwin No. 9		88032	228	128
Goodwin No. 10		88033	228	128
Goodwin Creek		88034	228	128
Goodwin No. 12		88035	228	129
Goodwin No. 13		88036	228	129
Goodwin No. 14		88037	228	129
Goodwin No. 15		88038	228	129
Goodwin Discovery No. 1		88027	228	127
Goodwin Discovery No. 2		88029	228	128
Goodwin Discovery No. 3		88031	228	128

PLACER WORKINGS

Evidence was found of several periods of placer exploration on all creeks in the Cape Mountain placer district, but workings of a size to indicate significant production of placer tin were found only on Cape Creek and Goodwin Gulch. In addition to the churn-drill holes sunk by the Bureau of Mines in 1943, there was evidence of extensive churn-drilling programs on Boulder, Goodwin, and Cape Creeks. Local residents report that several samples also were obtained from the gravels underlying Lopp Lagoon by drilling through the ice during the winter months. The only records of this work are incomplete data on drill holes in Cape Creek-Goodwin Creek area. These holes were drilled during mining operations, and most of the tin has since been mined; therefore, the data have not been included in this report.

Cape Creek

A narrow band of "upper gravels" in the main channel of Cape Creek has been worked from the beach to a point about 500 feet below the mouth of First Chance Creek (see fig. 24, p. 45). Except for drill holes and prospect pits, there are no recognizable workings on First Chance Creek or Cape Creek between the above-mentioned workings and drill-hole line 3. (See fig. 7.) Some shallow excavation is evident along the Cape Creek channel between drill-hole lines 3 and 4-B. No workings were found on East Fork except a shallow ditch to bring water to Cape Creek.

A placer pit ranging in width from 25 to about 200 feet extends approximately 3,000 feet up Cape Creek from line 4-B, and small, irregular pits extend several hundred feet farther upstream. The larger pit was excavated by American Tinfields, Inc., in the late 1930's; the smaller pits appear to be considerably older.

Goodwin Creek-Goodwin Gulch

A narrow gravel deposit in the channel of Goodwin Gulch was worked from the junction of the gulch with Goodwin Creek upstream about 4,500 feet (see fig. 38, p. 68). This placer pit is noticeably wider and deeper toward the headwaters. The only other workings are in a small, shallow bench deposit on the left limit (north side) of Goodwin Gulch a few hundred feet west of Goodwin Creek. No placer pits were evident on Goodwin Creek, although old sluice boxes and other equipment suggest that a little work may have been done. The recognizable pits on Goodwin Gulch were dug by American Tinfields, Inc., between 1935 and 1941. Few traces remain of earlier mining activity in the area.

Recovery Plant

Early miners on Cape Creek and Goodwin Gulch excavated by hand and recovered the tin in sluice boxes. The small, erratic water supply limited operations.

Tin was recovered principally by American Tinfields, Inc., who used a small power shovel to excavate the gravel and light dump trucks to transport it to a mill. The largest mill was a short distance east of the mouth of Cape Creek on the shore of the Bering Sea. A smaller mill at the junction of Goodwin Gulch and Goodwin Creek appears to have served as roughing plant. Most installations have been destroyed by weathering. Production is reported to have been 9,000 to 10,000 cubic yards of gravel per working season, costing about \$2.50 per cubic yard.

The following description of the recovery methods used by American Tinfields, Inc., is quoted from Geological Survey Bulletin 897-A, The Mineral Industry of Alaska in 1936:

The placer material is dug with a power shovel, which loads it into trucks that carry it * * * to the mill * * *. Here the material

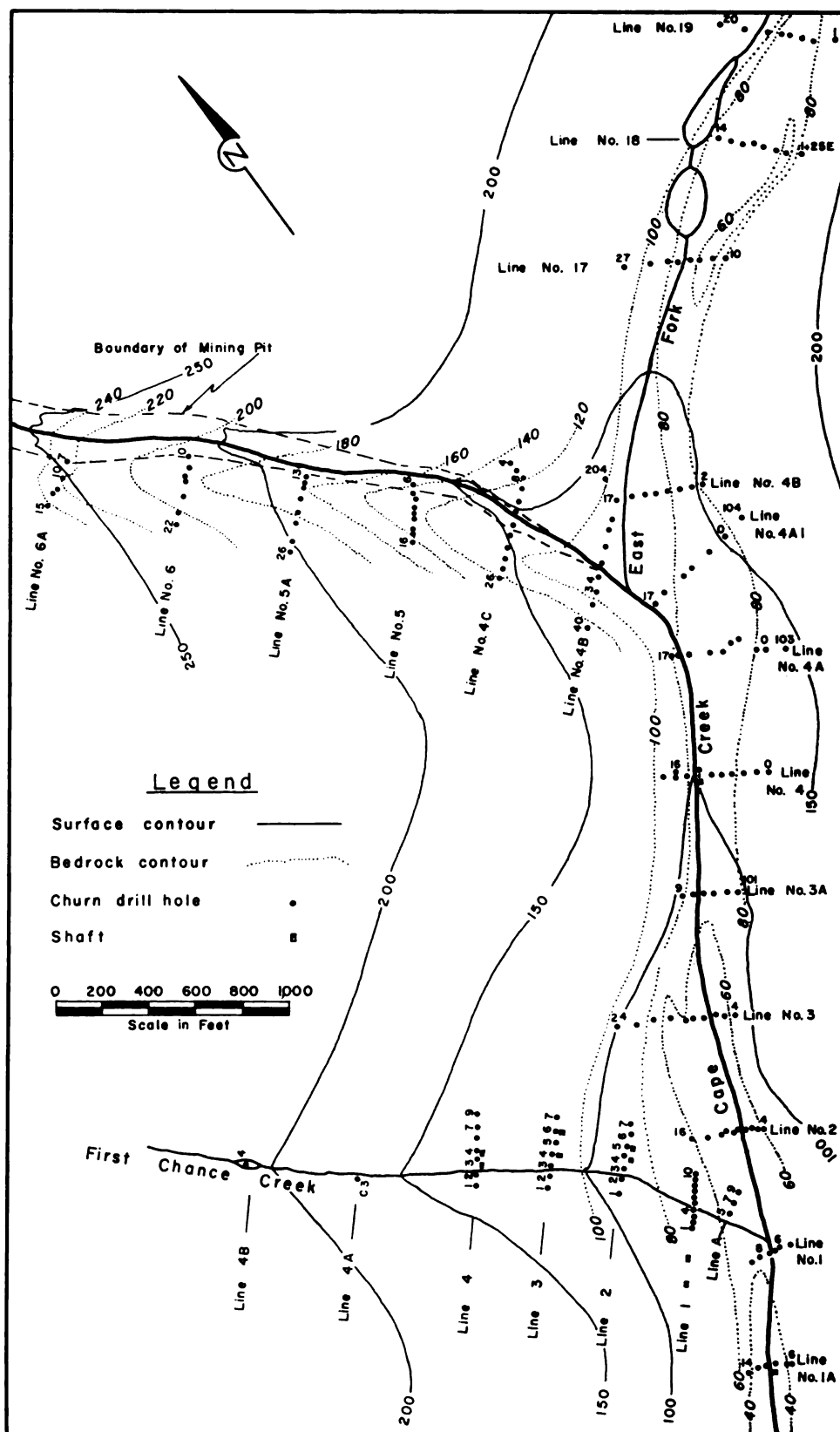


FIGURE 7. - Cape Creek Churn-Drill Exploration.

is dumped over a grizzly, by which the large masses of country rock are gotten rid of and the rest passed through a revolving trommel which eliminates more of the worthless material. The fine material is then passed through a series of sluice boxes so arranged in three lines that, whenever necessary to clean up the concentrates from one line of boxes, the feed can readily be diverted to another without interrupting the flow. The coarse concentrates from the boxes are broken into small pieces in a jaw crusher, and these, together with the rest of the concentrates from the boxes, are still further cleaned by passing through jigs. Experimentation with treating on concentrating tables some of the waste product from the jigs showed that losses from that source were so small that this additional step did not pay, and consequently it was discontinued for most of the time.

GENERAL GEOLOGY

The main mass of Cape Mountain is a roughly circular, granitic stock, which has intruded a dominantly limestone country rock. Lode-tin mineralization in the form of cassiterite has been found in both granite and limestone adjacent to the contact zone on the northeast flank of the mountain. This area is drained by the headwaters of Cape Creek, Goodwin Gulch, and Boulder Creek. (See fig. 3, p. 6.) Part of the placer tin in these streams must have been derived from the contact zone; however, some tin evidently came from deposits within the limestone at a considerable distance from the granite contact, particularly on First Chance Creek where the upstream holes contained almost no tin and the test shafts farther downstream contained angular fragments of tin-bearing (cassiterite) rock showing little evidence of travel. There is also evidence that a mineralized fault or shear zone, with a generally north-south orientation, may pass through the head of Goodwin Gulch and Cape Creek near the upstream limits of placer mining. The existence of this structure has not been substantiated, but additional study of these deposits is needed.

On line 88, Boulder Creek, the gravels contained seashells and water-rounded beach pebbles at approximately 80 feet above the present sea level. (See fig. 25, p. 49.) The shells resembled those on the present beaches. Wave and current action may have dispersed placer concentrations below this level.

BUREAU OF MINES WORK

The Bureau of Mines maintained an engineer on the Zenda Gold Mining Co. property throughout the 1952 season. During the 1953 season the Bureau engineer occasionally visited the property. This engineer,^{6/} acting as the representative of the Defense Minerals Exploration Administration field team, checked the drilling, shaft sinking, and sampling procedure and assisted company officials in planning their exploration program. Independent surveys of the claims, drill holes, and shafts also were made as the work progressed, these data have been used throughout this report.

^{6/} John J. Mulligan, mine examination and exploration engineer, Bureau of Mines, Region I, Juneau, Alaska.

The Alaska Mining Experiment Station at Juneau, Alaska, performed check analyses on samples from all drill holes that contained heavy mineral concentrates, and these data also have been used throughout the report.

Some data obtained during previous work by the Bureau of Mines have been included in the tables and maps to give a complete picture of the area. The letters BM preceding the hole or lime number identify these data.

COMPANY OPERATIONS

Management

The Zenda Gold Mining Co. is incorporated under the laws of the State of Delaware. During most of the period covered by this report the main office was at 635 Securities Building, Seattle 1, Wash. In 1951, when the exploration program was begun, the policies and operations of the company were under the direction of Norman C. Stines, general manager, who continued in this capacity until he terminated his association with the company in February 1953. The company was then operated under the direction of the executive manager, J. U. M. Troy, until his death in November 1953, after which exploration was discontinued.

Nature and Extent of Work

The work covered in this report was performed by the Zenda Gold Mining Co. under the terms of a Defense Minerals Administration contract dated July 9, 1951. This contract and subsequent amendments specified that churn-drilling and a limited amount of shaft sinking be conducted in the placer gravels of the Cape, Goodwin, and Boulder Creek drainages; all claims owned or controlled by the company on these streams were included in the contract and in the obligation of the company to repay the Government if exploration resulted in a discovery.

The preparatory work was begun immediately after the contract was signed, and exploration continued throughout two working seasons. In 1951 an office was established in Nome and equipment collected. The churn drill, tractor, and most other heavy equipment were shipped by barge to Tin City, at the mouth of Cape Creek, late in the fall of 1951. Additional equipment and supplies were hauled to Tin City by tractor-drawn sleds during the winter of 1951-52. Exploration was begun in the spring of 1952 and recessed in mid-October, work was resumed in mid-June 1953 and continued until the end of September. In 1952, 209 churn-drill holes, totaling 7,521 feet, and 10 test shafts, totaling 96 feet, were excavated on Cape Creek, First Chance Creek, East Fork, and Cape Creek Beach, all of which are included in the Cape Creek drainage. During 1953, 86 churn-drill holes, totaling 3,157 feet, were bored on Boulder Creek. To comply with the terms of the contract, the company planned to drill Goodwin Gulch and Goodwin Creek during the summer of 1954 so the equipment was stored on the property at the end of the 1953 season; however, no further work was done.

Sampling Procedure

The drilling and sampling methods were the conventional placer procedures used in permafrost areas throughout northern Alaska. Drilling was done with a self-propelled churn drill having a tool string and drill bits designed for use with a 6-inch drive pipe. The drive pipe had a nominal inside diameter of 6 inches, and the cutting edge of the drive shoe had an outside diameter of 7-1/2 inches. The drive shoe and drive pipe were used to penetrate thawed ground. Open holes (no casing) were drilled in frozen ground. The samples from the drill holes were roughly concentrated by rocker, then panned; the panner estimated the amount of cassiterite and noted its location in the drill hole. The samples were dried, weighed, sacked, and submitted for analysis. Drilling and sampling data were recorded by the panner as drilling progressed. The form used was a standard field log developed for use in drilling frozen ground and stocked by local printers. After each hole was completed, the driller-foreman checked the log and recopied it in ink on a clean form. To prevent loss of data due to haphazard communications, the panner's log was kept at the prospect. The pen-and-ink copy was sent to the company office and recopied on a typewriter. A carbon copy was later checked against the panner's original.

The work was under the direct supervision of a foreman, who also worked as a driller. The number of employees normally consisted of 2 drilling crews with 1 mechanic and 1 cook to serve both crews. Each drilling crew comprised 1 driller, 1 helper, 1 panner, and sometimes 1 laborer. The drilling crews worked 10 hours per day 7 days a week. The driller-foreman and his crew worked days, and the other driller and his crew worked nights. In addition to drilling, the crews sank a few test shafts when the drill could not be operated owing to mechanical breakdowns.

The test shafts yielded little pertinent data. They were sunk to check drilling accuracy and to obtain data on ground characteristics and sizing for planning mining and milling procedure. Of 8 shafts begun on First Chance Creek, 4 were completed to bedrock. Sinking and sampling were done efficiently and competently, but the data have no bearing on the value or characteristics of the upper Cape Creek gravels where the discovery was made. Two shafts were started on Cape Creek; both penetrated only a layer of near-surface gravel. The sizing and other data obtained from these shafts cannot be used to evaluate the deeper gravels whose characteristics may be entirely different. The company could not sink shafts into the deep ground where the discovery was made because suitable thawing equipment was lacking.

Definition of Terms

Zenda Gold Mining Co. churn-drilling results are calculated and summarized in accordance with normal placer-evaluation procedures as adapted to permafrost areas. The following definitions are used:

The overburden (O.B.) is a mixture of organic material, rock-decomposition products, and ice, which is called "muck" by Alaskan placer miners. Usually a dense mat of moss and tundra vegetation, ranging in thickness from

1 to 3 feet, covers the overburden and serves as an insulator to prevent thawing during the summer.

The pay horizon (P.H.) is that section of the hole yielding a heavy-mineral concentrate. In cased holes the volume of the pay horizon is the area encompassed by the cutting edge of the casing shoe multiplied by the depth of the pay horizon. In uncased (open) holes (in frozen ground), the sample volume is determined by measuring the volume of water required to refill the pay horizon. In a few open holes, where no water measurement was made, the volume of the pay horizon is an estimate based on the measured volume of the pay horizon in nearby uncased holes.

The mining section (M.S.) is the total depth of the gravel and bedrock that would be handled during mining. In these calculations, all gravel and 1 foot of bedrock are included in the mining section. A study of the drill-hole logs indicates that thawing of part of the mining section will result in considerable shrinkage of the section. The logs also indicate that some gravel is present in the muck section. It is estimated that gravel in the muck section will add to the mining section and eliminate any advantage gained from shrinkage. In several places two layers of pay gravel are separated by a layer of muck. By careful planning of stripping and thawing, the top pay can be brought into the mining section with the lower pay.

Method of Evaluation

The volume of the mining section, the amount of concentrate per cubic yard, and the amount of tin per cubic yard were calculated as follows:

$$(\text{Vol. P.H., cu. ft.}) \frac{\text{depth of M.S.}}{\text{depth of P.H.}} = \text{vol. M.S., cu. ft.}$$

$$\frac{27 (\text{wt. concentrate, lb.})}{\text{Vol. M.S., cu. ft.}} = \text{concentrate, lb./cu. yd. in M.S.}$$

$$(\text{Concentrate, lb./cu. yd. in M.S.}) (\text{tin in concentrate, percent}) = \text{tin, lb./cu. yd. in M.S.}$$

To simplify reporting the pay horizon and pay-horizon volume have been deleted from the tables, and the calculated volume of the mining section has been substituted. The pay horizon is shown on the sections included with the descriptions of the individual deposits.

DESCRIPTION OF DEPOSITS AND SAMPLING RESULTS

Exploration by the Zenda Gold Mining Co. in the Cape Mountain area and previous drilling by the Bureau of Mines outlined four distinct deposits of placer tin: Cape Creek deposit, First Chance Creek deposit, Cape Creek Beach deposit, and Boulder Creek deposit. The company also planned to drill Goodwin Creek and Goodwin Gulch, but this part of their program was abandoned.

The Cape Mountain placer deposits are within an Air Force Reserve. In an agreement with the Zenda Gold Mining Co., the Department of the Air Force recognizes the right of the company to mine these deposits. The restrictions and limitations on this right depend upon the judgment of the commanding officer of the local installation.

Maps, sampling data, and descriptions of the individual deposits follow.

Cape Creek

The company's exploration program on Cape Creek resulted in a Certification of Discovery being issued by the Defense Minerals Exploration Administration (DMEA) on March 22, 1956. Drilling and sampling revealed a placer-tin deposit extending from drill-hole line 1A (near the mouth of First Chance Creek) upstream on Cape Creek to line 6A and up East Fork to line 17. (See fig. 7, p. 16.) On Cape Creek above line 6A the gravels are comparatively shallow; a number of small worked-out placer pits suggest that this section of the deposit may have been exhausted. On East Fork a narrow, deeply buried paystreak extends upstream from line 17 but was not encountered in lines 18 and 19. The tin (cassiterite) was discovered in the buried gravels of an ancient channel on bedrock, below the present drainage and separated from the gravels of the present stream by a thick layer of muck and ice. Except for the top few feet, the deposit and overburden remain permanently frozen. Boulder sizes, gravel sizes, percentage of solids in the muck, and other pertinent data were not obtained because the company lacked equipment to sink test shafts through the frozen overburden.

The Cape Creek deposit is shown in figures 7 through 23. Tables 6 and 7 give graphic, radiometric, and spectrographic analyses of three representative samples of churn-drill concentrates from the deep pay horizon. Drill-hole data and tin analyses are summarized in table 8.

First Chance Creek

On First Chance Creek the Zenda Gold Mining Co. sank 7 drill holes and started 8 shafts; 4 shafts were completed to bedrock. The company's objective was to check the grade and extent of the deposit indicated by previous Bureau of Mines drilling and to determine the size range of the gravel and cassiterite.

A complete record of the shaft analyses data is not available for inclusion in this report. The ground on First Chance Creek contains many boulders and much coarse gravel; consequently, water thaws part of the deposit to bedrock, although most of it remains permanently frozen. Some cassiterite recovered from the First Chance Creek shafts was coarsely angular and attached to gangue, suggesting that it was not far from its lode source. This deposit deserves attention because it may indicate the presence of a lode deposit.

Figure 7, page 16, shows the First Chance Creek deposit, and table 9 summarizes sample data.

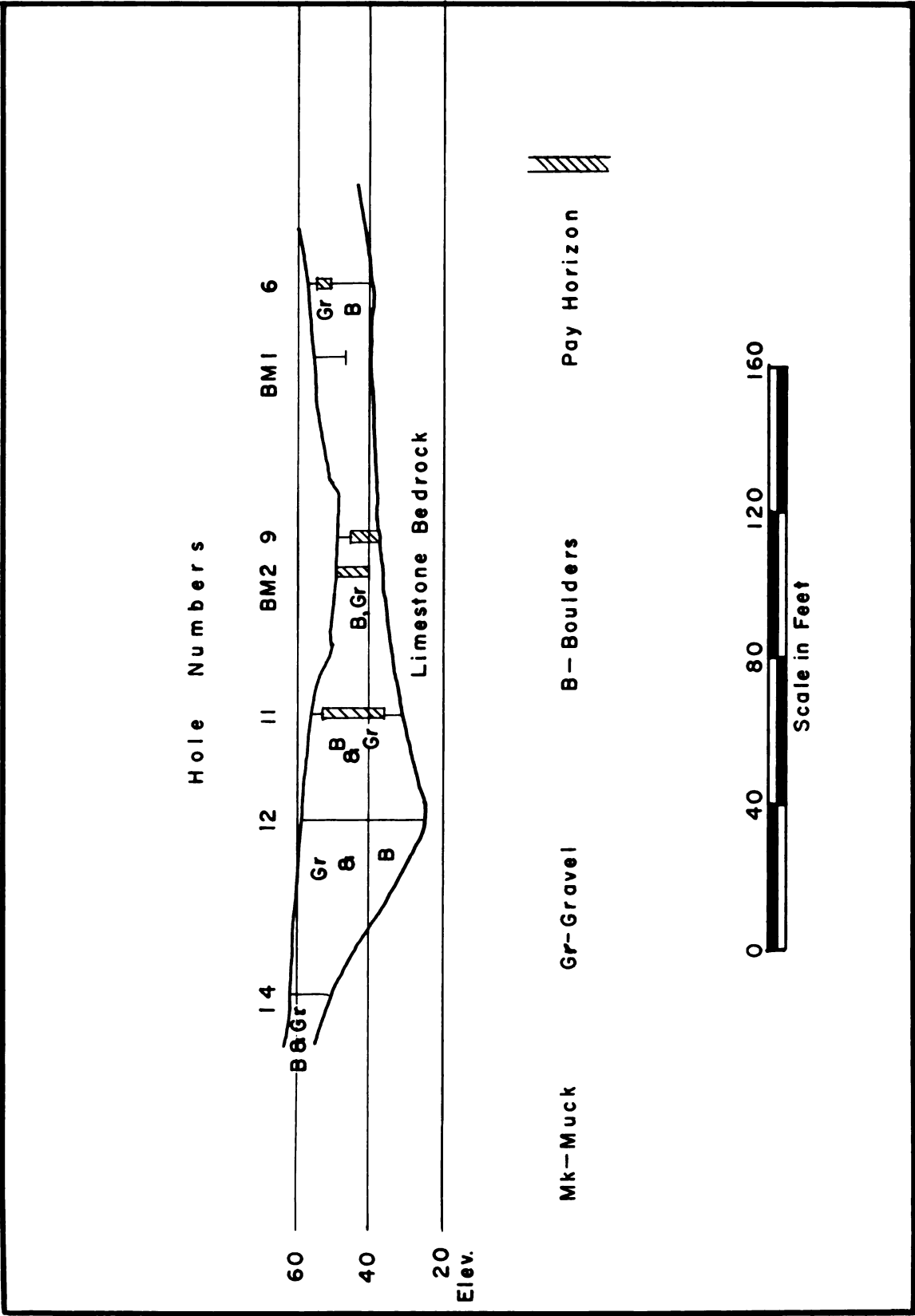


FIGURE 8. - Section on Line 1-A, Cape Creek.

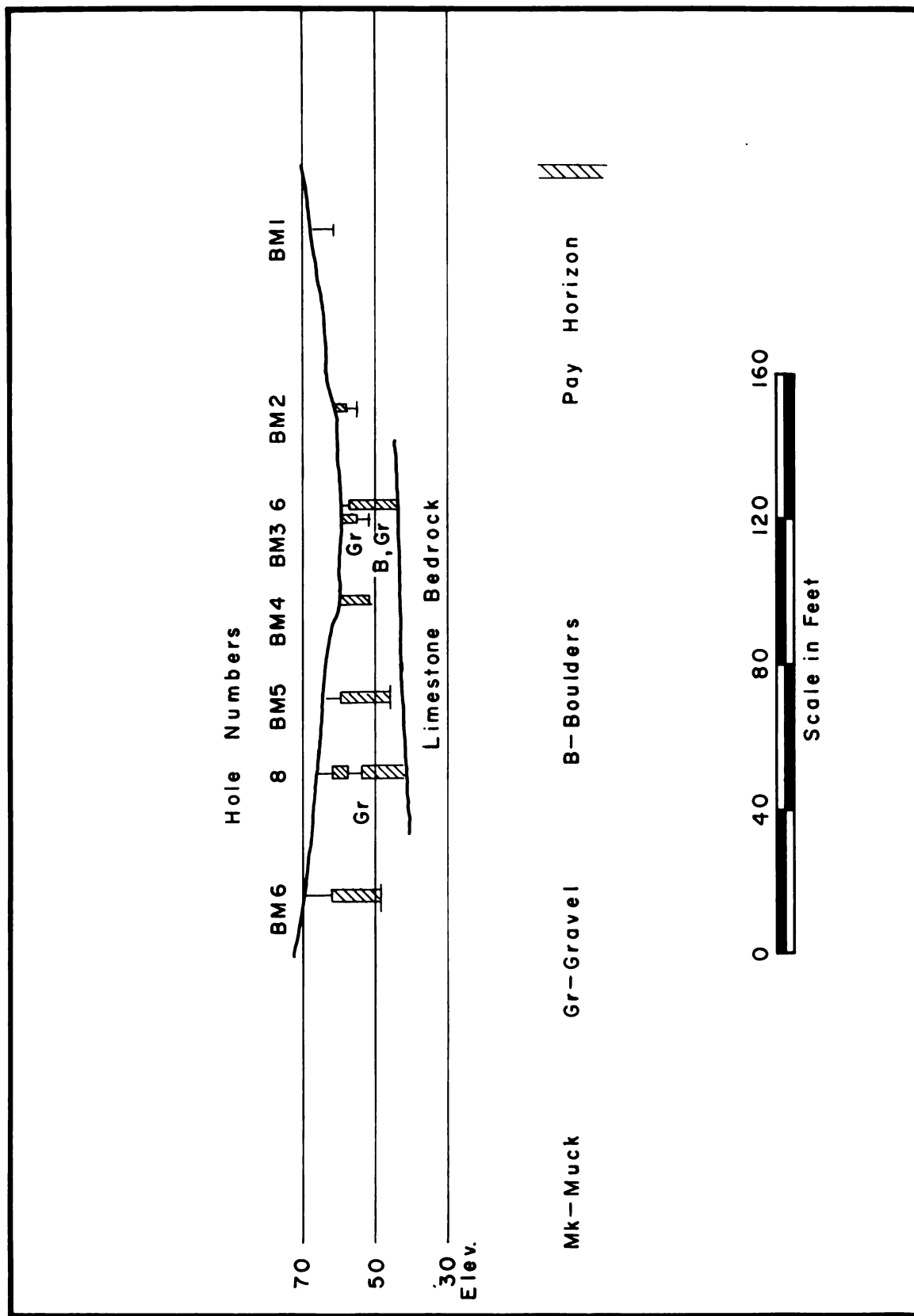


FIGURE 9. - Section on Line 1, Cape Creek.

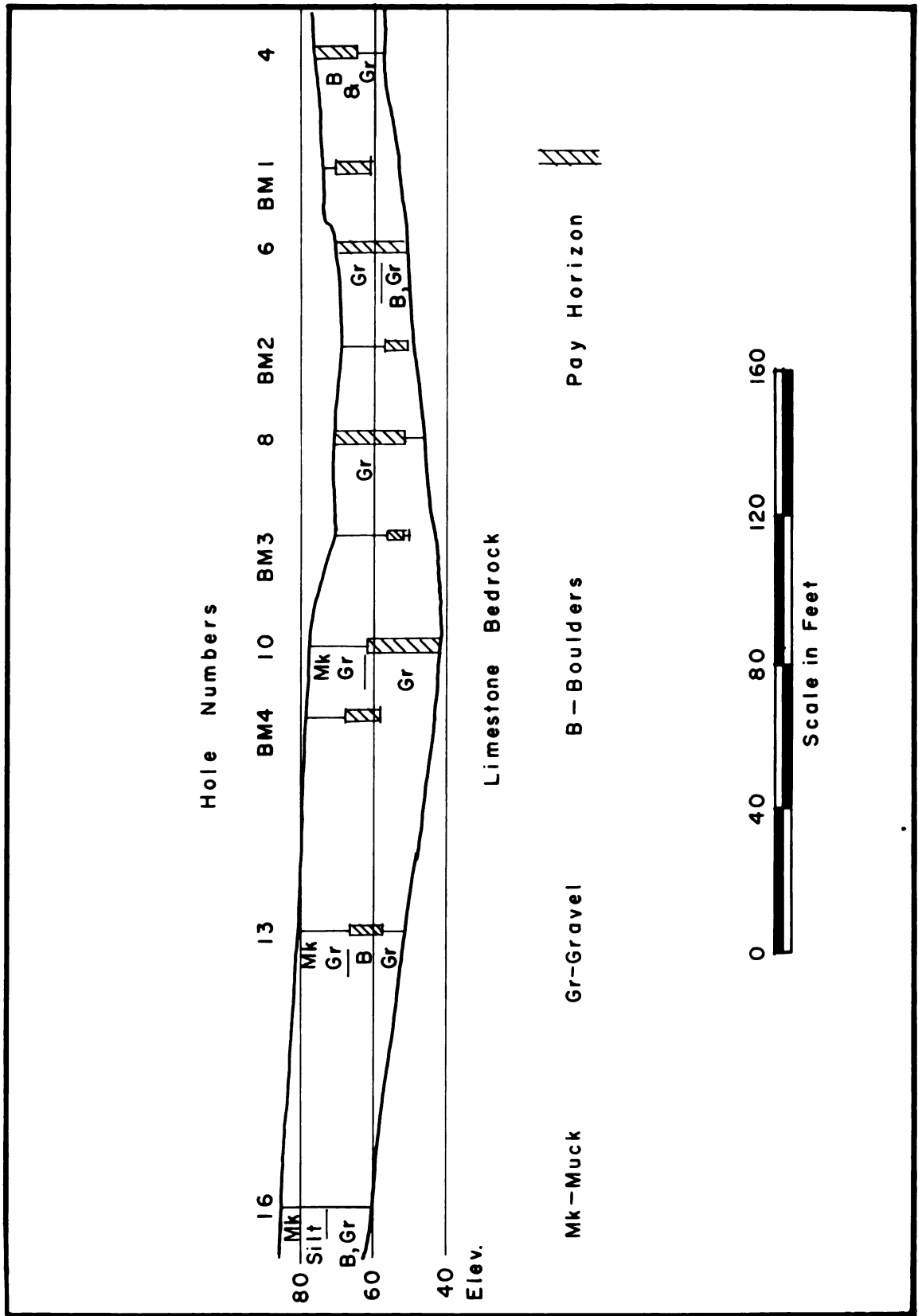


FIGURE 10. - Section on Line 2, Cape Creek.

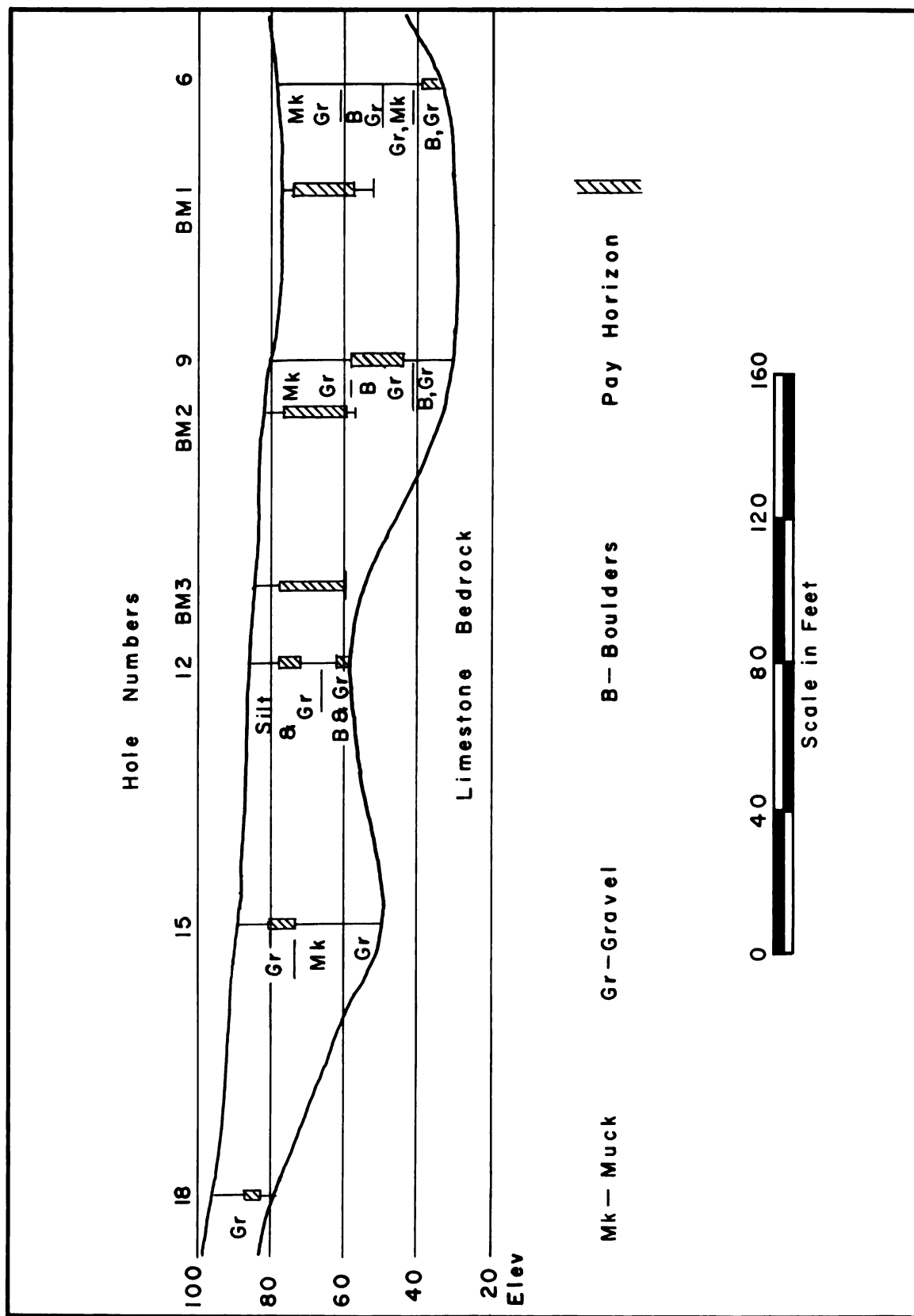


FIGURE 11. - Section on Line 3, Cape Creek.

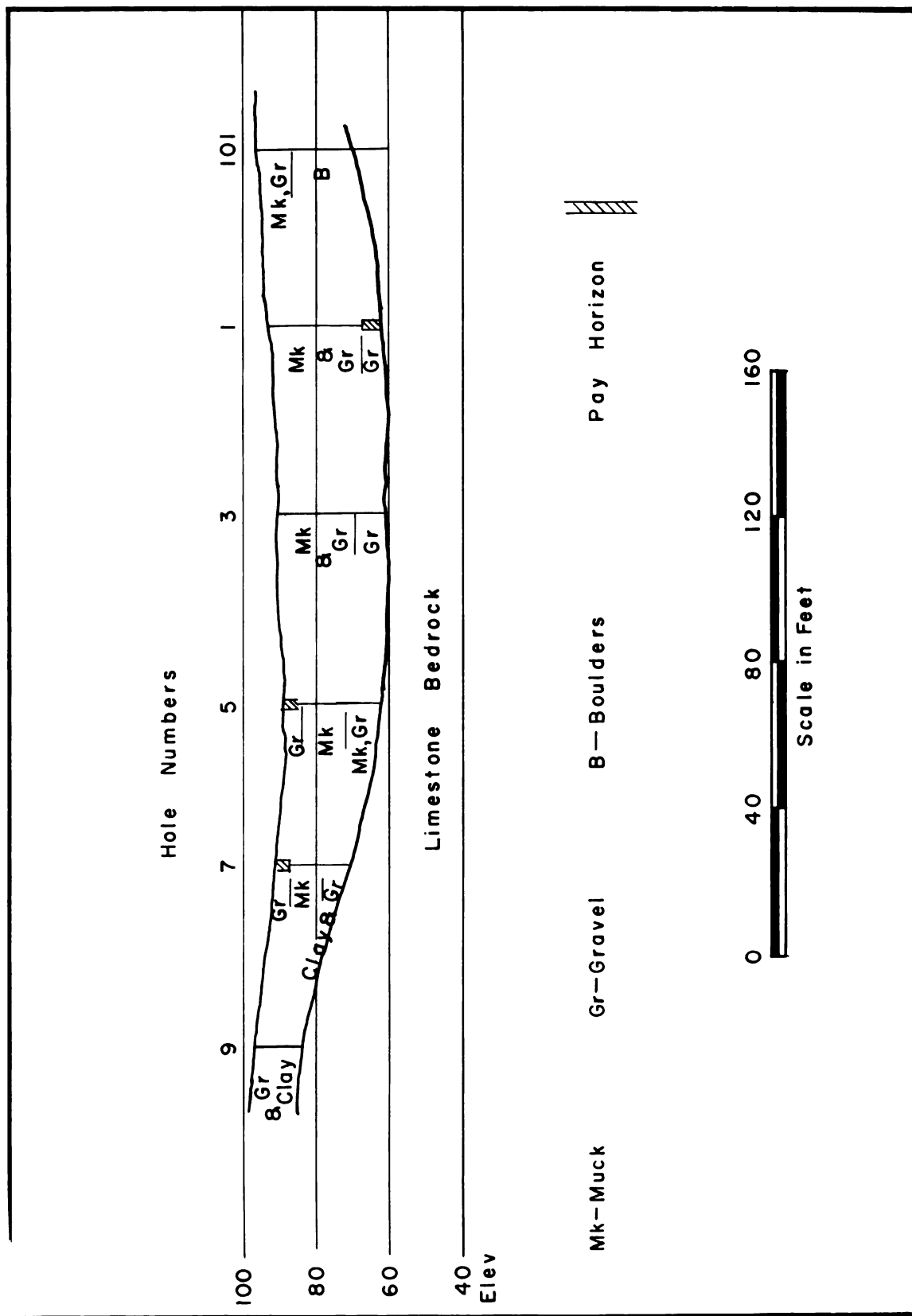


FIGURE 12. - Section on Line 3A, Cape Creek.

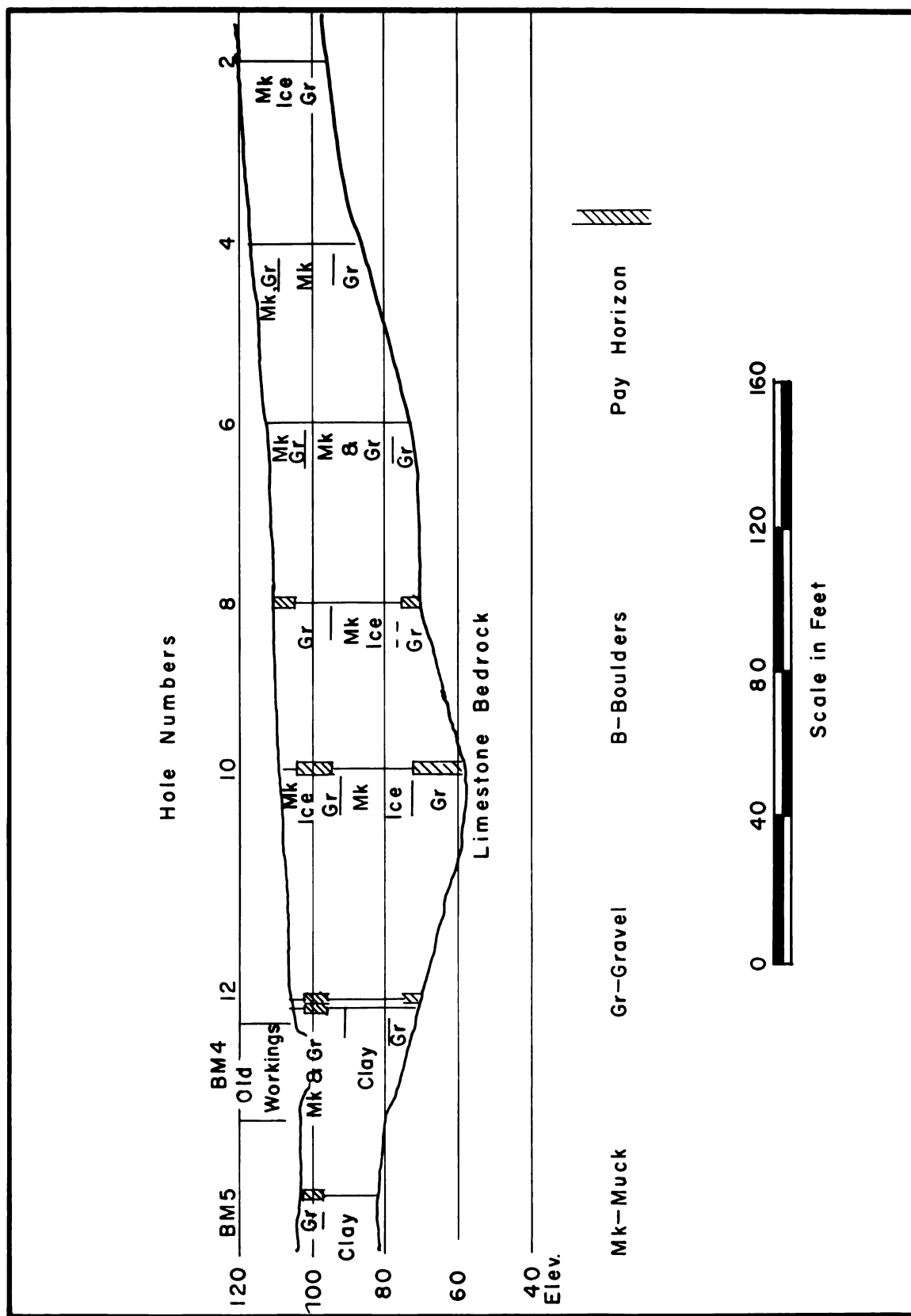


FIGURE 13. - Section on Line 4, Cape Creek.

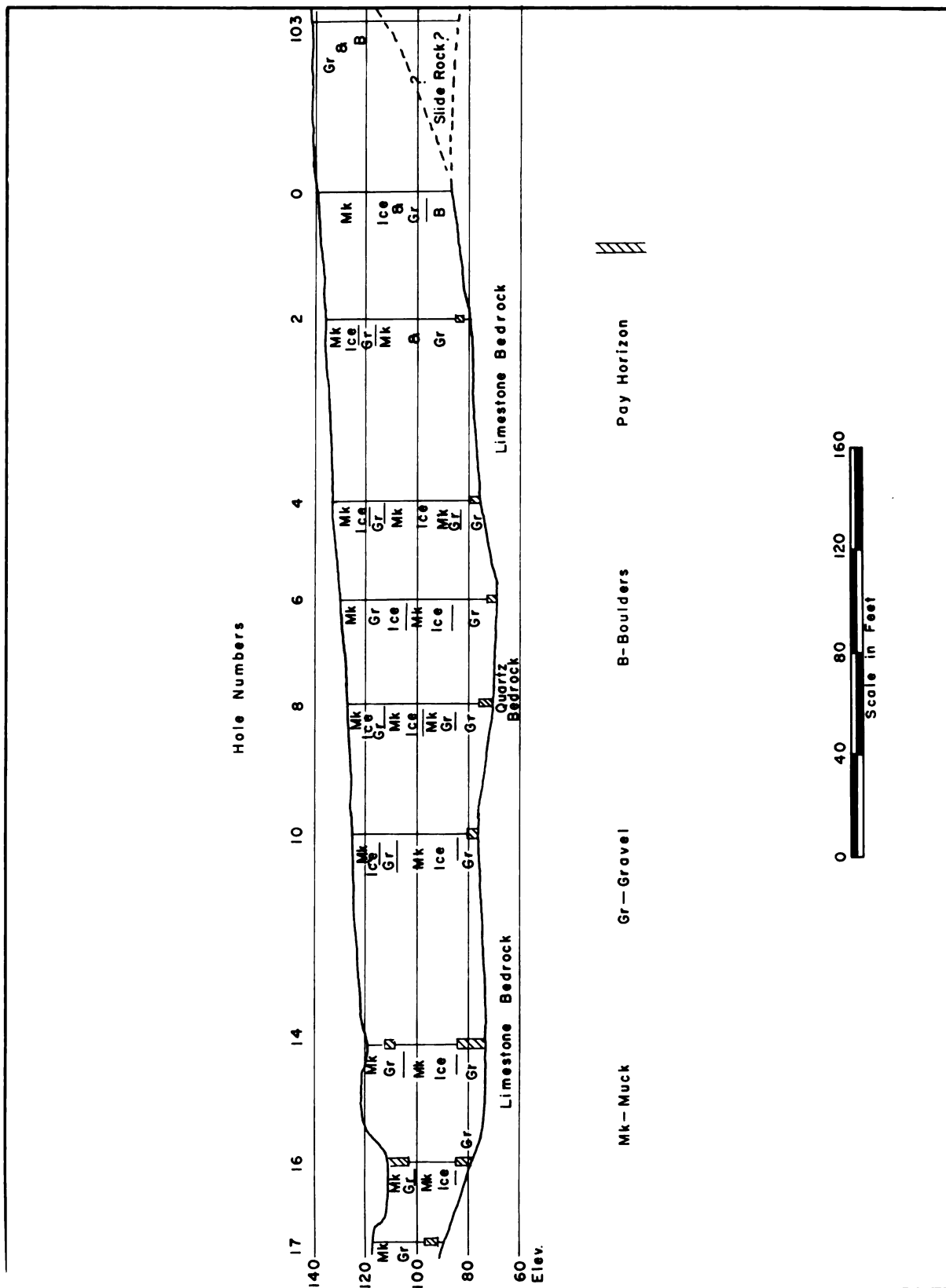


FIGURE 14. - Section on Line 4A, Cape Creek.

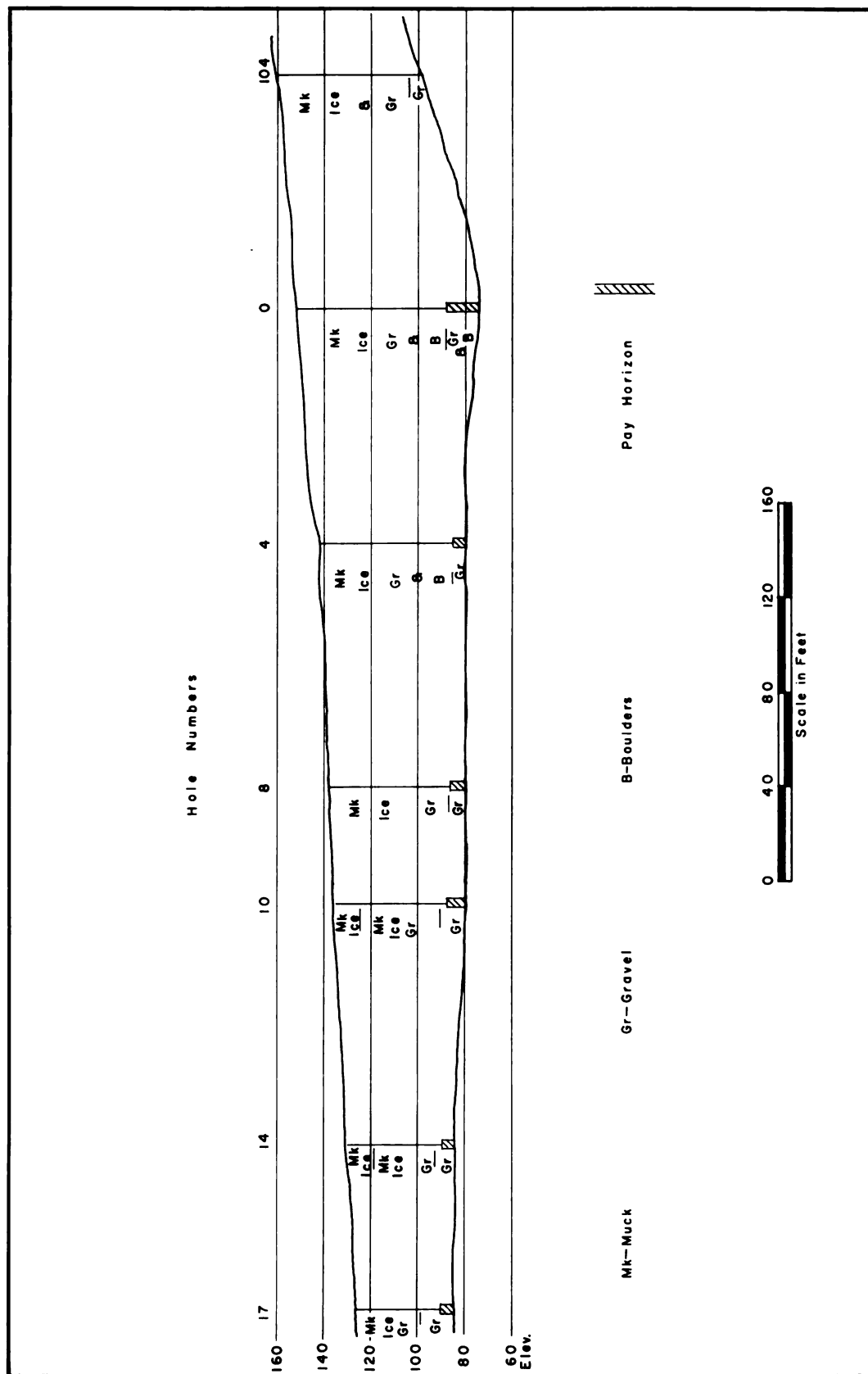


FIGURE 15. - Section on Line 4A-1, Cape Creek.

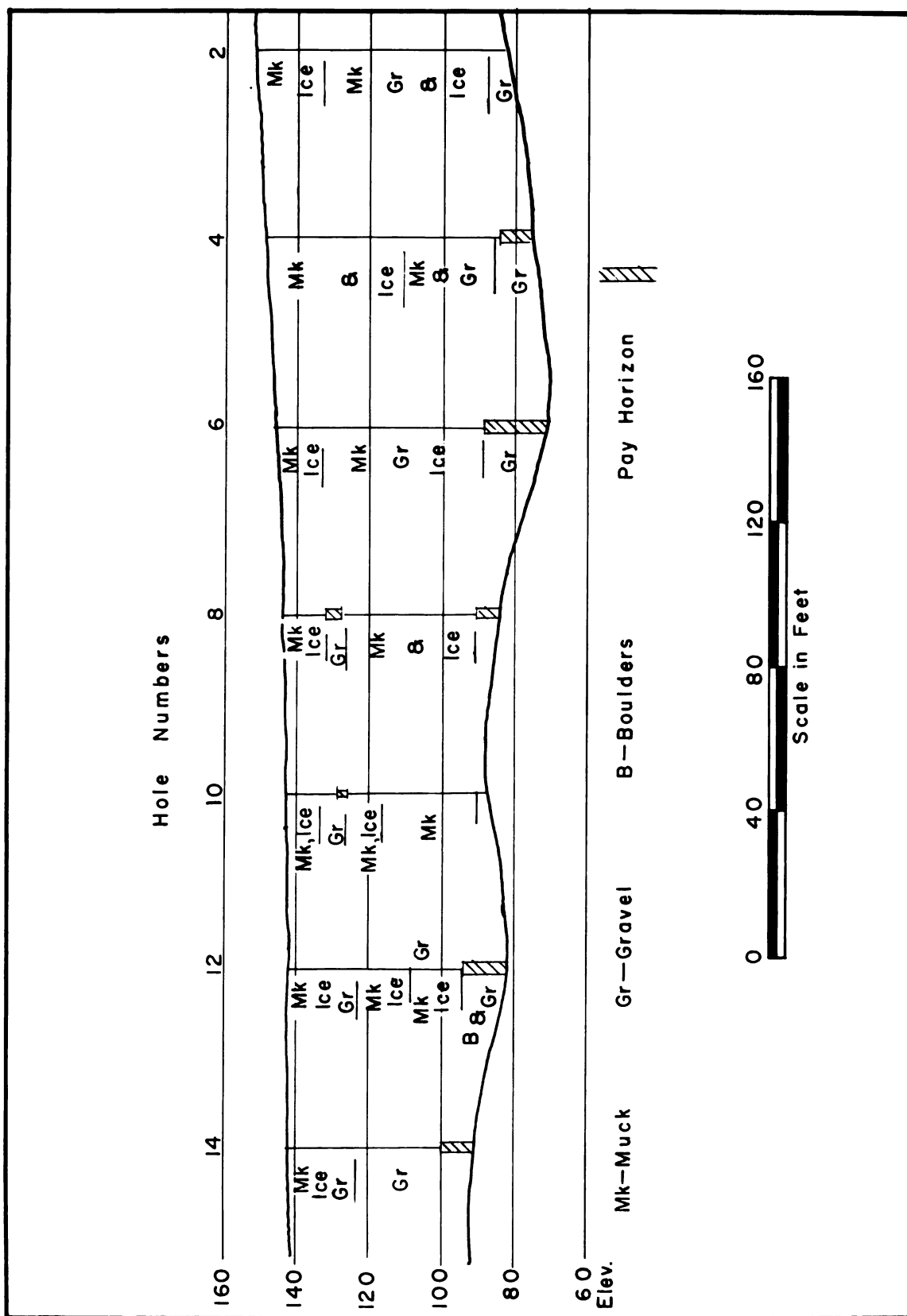


FIGURE 16. - Section on Line 4B, East Fork.

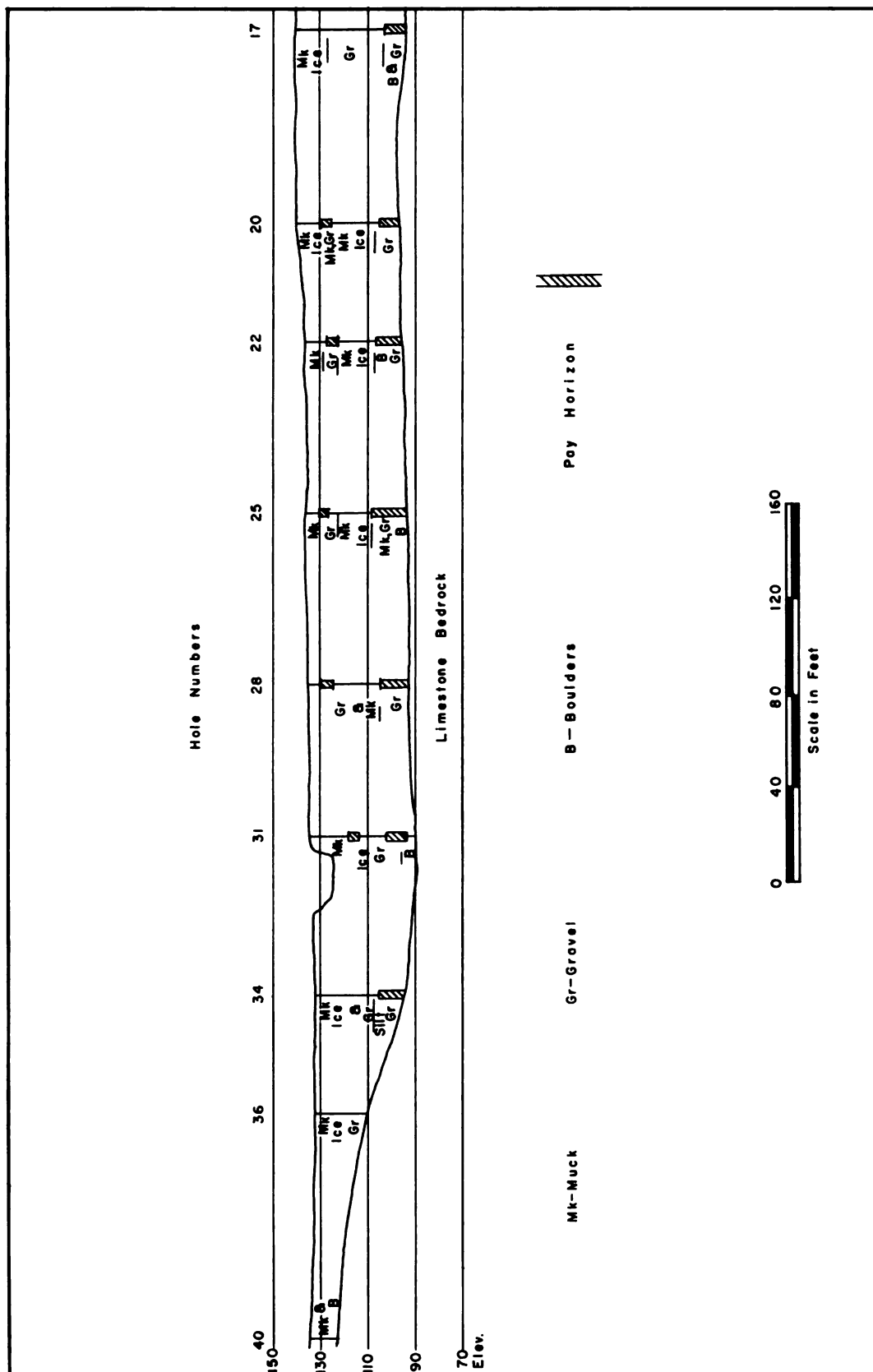
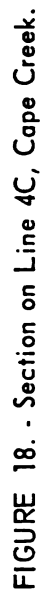


FIGURE 17. - Section on Line 4B, Cape Creek.



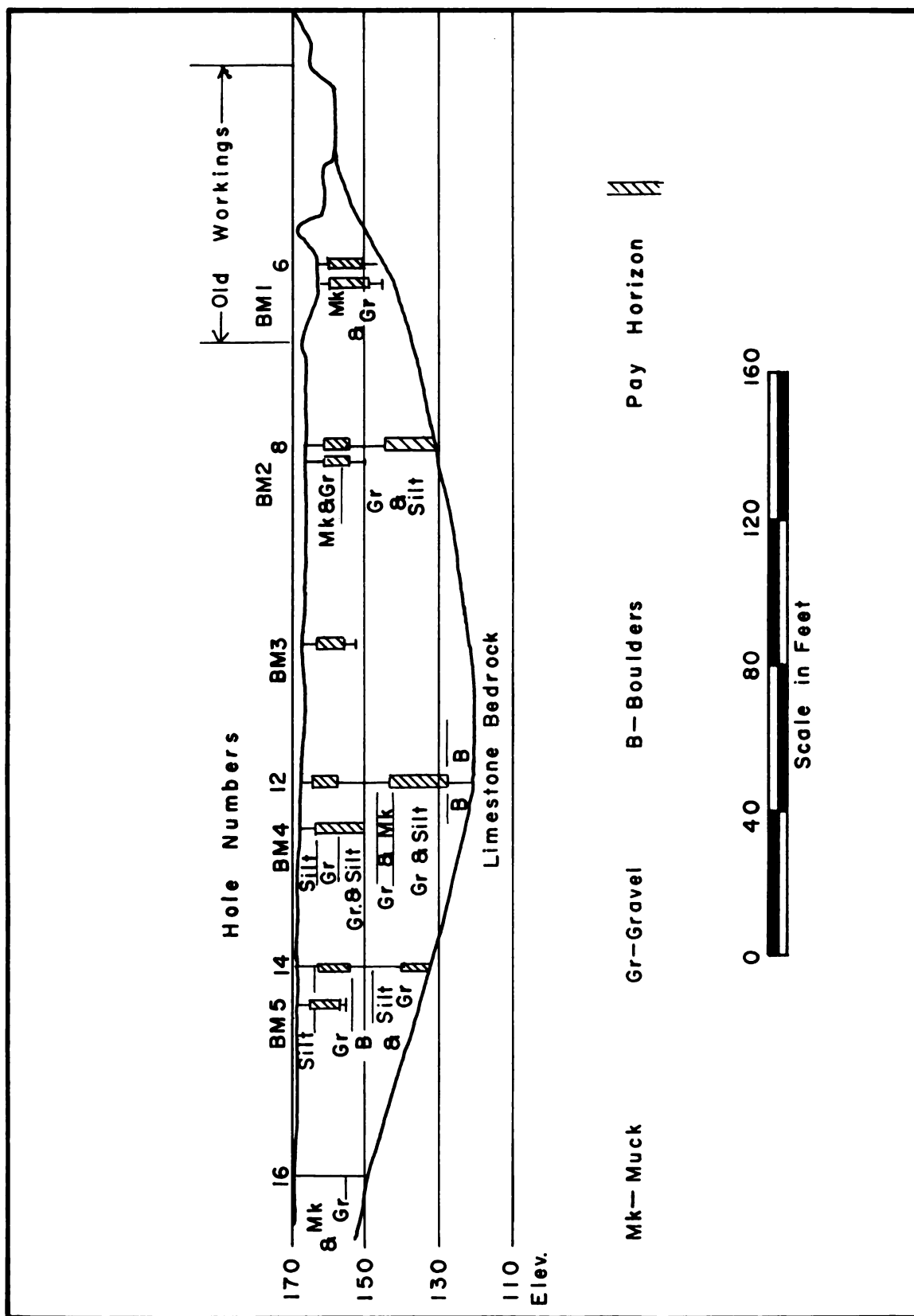


FIGURE 19. - Section on Line 5, Cape Creek.

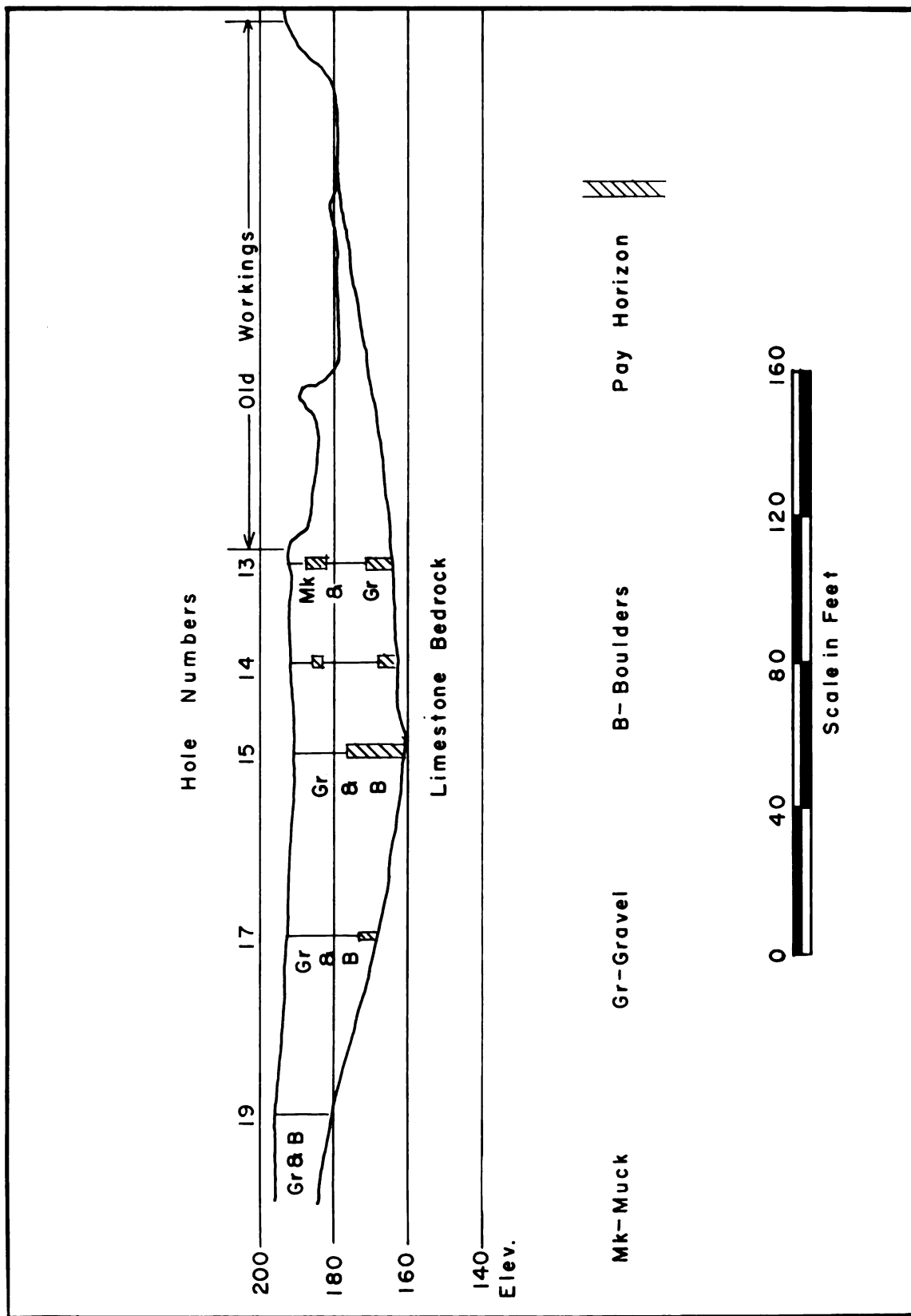


FIGURE 20. - Section on Line 5A, Cape Creek.

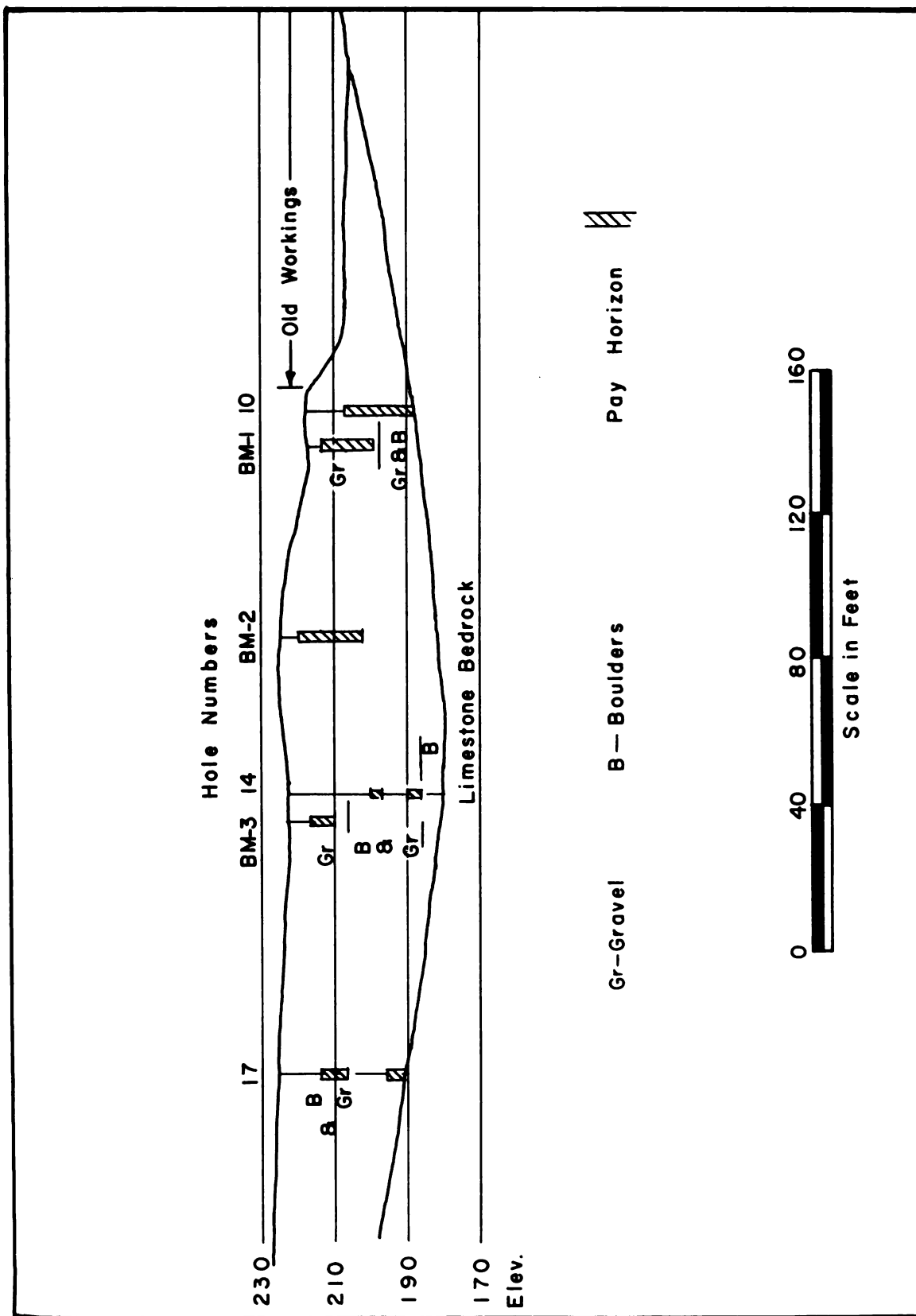


FIGURE 21. - Section on Line 6, Cape Creek.



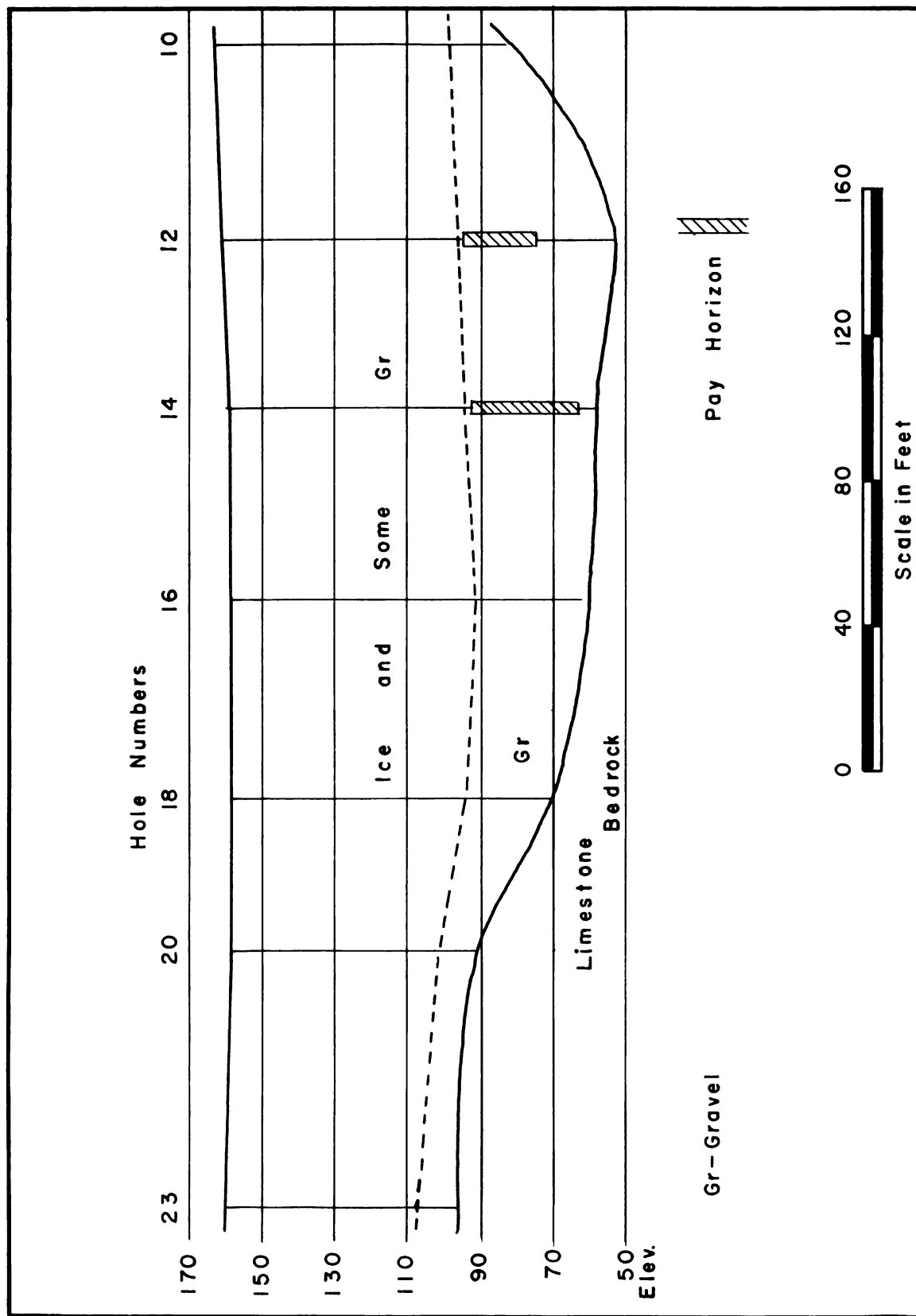


FIGURE 23. - Section on Line 17, East Fork.

TABLE 6. - Petrographic and radiometric analyses of 3 selected churn-drill concentrates from Cape Creek, percent^{1/}

	Line 5, hole 8	Line 4A, hole 14	Line 4C, hole 18
Cassiterite	70	40	40
Dolomite	30	) 30 (	40
Calcite	-	) (	20
Limonite	) <1 (	-	-
Quartz	) <1 (	2/20	Trace.
Clay	-	10	-
Vanadium	-	Trace.	-
Hornblende, epidote, diopside, blue tourmaline, and apatite	<.05	-	-

1/ No samples exhibited radioactivity. Chemical tests for molybdenum, tungsten, columbium, and tantalum also were negative.

No gold or silver was detected in any sample.

2/ With potash and soda feldspars.

TABLE 7. - Spectrographic analyses of selected churn-drill concentrates, Cape Creek^{1/}

	<u>Ag</u>	<u>Al</u>	<u>As</u>	<u>Au</u>	<u>B</u>	<u>Ba</u>	<u>Be</u>	<u>Bi</u>	<u>Ca</u>	<u>Cd</u>	<u>Co</u>	<u>Cr</u>	<u>Cu</u>	
Line 5, hole 8	-	C	D	-	E	-	G	E	A	-	E	E	F	
Line 4A, hole 14	-	C	D	-	E	-	G	E	A	-	F	E	F	
Line 4C, hole 18	-	B	D	-	E	-	G	E	A	-	E	E	F	
	<u>Fe</u>	<u>Ga</u>	<u>Ge</u>	<u>Hg</u>	<u>In</u>	<u>Li</u>	<u>Mg</u>	<u>Mn</u>	<u>Mo</u>	<u>Na</u>	<u>Nb</u>	<u>Ni</u>	<u>P</u>	
Line 5, hole 8	A	-	-	-	-	-	C	E	F	D	E	E	-	
Line 4A, hole 14	A	-	-	-	-	-	C	E	F	D	E	E	-	
Line 4C, hole 18	A	-	-	-	-	-	C	E	F	C	-	E	-	
	<u>Pb</u>	<u>Pd</u>	<u>Pt</u>	<u>Sb</u>	<u>Si</u>	<u>Sn</u>	<u>Sr</u>	<u>Ta</u>	<u>Te</u>	<u>Ti</u>	<u>V</u>	<u>W</u>	<u>Zn</u>	<u>Zr</u>
Line 5, hole 8	D	-	-	-	C	A	-	-	-	D	E	-	-	F
Line 4A, hole 14	D	-	-	-	B	A	-	-	-	D	E	-	-	F
Line 4C, hole 18	D	-	-	-	A	A	-	-	-	D	E	-	-	F

1/ Legend:

- A Over 10 percent.
- B 5 to 10 percent.
- C 1 to 5 percent.
- D 0.1 to 1 percent.
- E 0.01 to 0.1 percent.
- F 0.001 to 0.01 percent.
- G Under 0.001 percent.
- Not detected.

TABLE 8. - Summary of churn-drilling and shaft-sinking results, Cape Creek

Line No.	Hole No.	Drill-hole data					Concentrate		Mining section		
		Depth, feet					Weight, lb.	Tin, per-cent	Volume, cu. ft.	Conc., lb. per cu. yd.	Tin, lb. per cu. yd.
		Total	O.B.	Gravel	Bed-rock	M.S.					
1A	6	18	6	11	1	12	0.007	4.2	2.761	0.05	Trace
	9	14	-	11	3	12	1.420	26.8	3.682	10.41	2.79
	11	25	4	13	8	14	.293	32.0	4.285	1.85	.59
	12	35	3	31	1	-	-	-	-	-	-
	14	13	-	10	3	-	-	-	-	-	-
1	6	17	-	15	2	16	.364	2.3	4.909	2.01	.05
	8	26	1	23	2	24	2.253	32.8	5.568	10.93	3.58
2	4	21	-	19	2	20	.048	1.2	7.012	.19	Trace
	6	21	-	19	2	20	1.515	9.7	6.136	6.67	.65
	8	28	-	26	2	27	1.631	46.1	8.284	5.32	2.45
	10	39	15	21	3	22	.401	23.4	4.780	2.27	.53
	13	32	14	16	2	17	.278	38.0	4.082	1.84	.70
	16	27	6	19	2	-	-	-	-	-	-
3	4	10	-	8	2	-	-	-	-	-	-
	6	46	16	28	2	29	.046	3.7	5.800	.21	.01
	9	53	10	24	19	25	.194	8.5	5.140	1.02	.09
	12	29	6	21	2	22	.300	7.9	4.631	1.75	.14
	15	41	19	20	2	21	.057	6.3	4.422	.35	.02
	18	20	4	12	4	-	.007	-	-	-	-
	21	10	-	8	2	-	-	-	-	-	-
	24	10	-	9	1	-	-	-	-	-	-
3A	101	38	6	30	2	31	.066	2.1	7.347	.24	.01
	1	33	22	10	1	11	.397	35.6	2.523	4.25	1.51
	3	31	2	27	2	28	.020	-	8.590	.06	.00
	5	30	-	28	2	-	.044	-	-	-	-
	7	22	-	20	2	-	Trace	-	-	-	-
	9	15	2	11	2	-	-	-	-	-	-
4	0+75E	84	25	58	1	-	.011	20.1	-	-	-
	2	26	11	12	3	-	.018	15.7	-	-	-
	4	31	26	4	1	-	-	-	-	-	-
	6	41	37	3	1	-	-	-	-	-	-
	8	43	30	10	3	11	1.618	64.7	2.031	21.51	13.92
	10	52	22	28	2	29	3.613	14.0	5.832	16.73	2.34
	12	39	10	26	3	27	3.638	13.3	7.771	12.64	1.68
	16	28	3	21	4	-	Trace	6.2	-	-	-
4A	103	63	21	38	5	-	-	-	-	-	-
	0	55	41	11	3	-	-	-	-	-	-

TABLE 8. - Summary of churn-drilling and shaft-sinking results, Cape Creek (Con.)

Line No.	Hole No.	Drill-hole data					Concentrate		Mining section		
		Depth, feet					Weight, lb.	Tin, per cent	Volume, cu. ft.	Conc., lb. per cu. yd.	Tin, lb. per cu. yd.
		Total	O.B.	Gravel	Bed-rock	M.S.					
4A	2	59	47	8	4	9	0.018	6.5	$\frac{1}{1.8}$	0.27	0.02
	4	60	45	12	3	13	.165	71.4	$\frac{1}{2.6}$	1.71	1.22
	6	62	45	15	2	16	.060	68.4	$\frac{1}{3.2}$	.51	.35
	8	61	42	15	4	16	.198	72.2	2.456	2.18	1.57
	10	49	40	8	1	9	.661	68.5	1.728	10.33	7.07
	14	47	30	15	2	16	9.941	21.7	3.222	83.30	18.08
	16	35	16	17	2	18	.891	29.6	3.497	6.88	2.04
	17	29	20	4	5	5	Trace	-	-	-	-
4A1	104	61	56	3	2	-	-	-	-	-	-
	0	79	58	20	1	21	.291	34.2	4.410	1.78	.61
	4	67	53	10	4	12	.811	57.2	2.183	10.03	5.74
	8	61	48	10	3	12	.232	59.2	2.437	2.57	1.52
	10	58	45	10	3	12	3.600	70.0	2.077	46.79	32.75
	14	46	38	6	2	7	.064	70.0	1.243	1.39	.97
	17	43	35	6	2	7	.417	68.3	1.213	9.28	6.34
4B	2	70	63	6	1	-	-	-	-	-	-
	4	74	63	8	1	9	.227	67.7	1.566	3.91	2.65
	6	76	58	16	2	17	1.629	27.1	3.116	14.12	3.83
	8	60	54	4	2	5	.071	3.8	.905	2.12	.08
	10	55	48	6	1	7	.060	59.8	1.267	1.28	.76
	12	62	45	14	3	15	.351	57.3	3.242	2.92	1.67
	14	52	18	31	3	32	.582	43.7	6.915	2.27	.99
	204	47	16	28	3	29	.298	37.6	6.687	1.20	.45
	17	49	9	38	2	39	3.713	40.1	8.315	12.06	4.83
	20	45	33	9	3	10	.538	49.8	2.250	6.46	3.22
	22	43	30	11	2	12	1.400	33.0	2.558	14.77	4.88
	25	45	31	11	3	12	.650	24.2	2.510	6.99	1.69
	28	44	24	18	2	19	.750	39.0	4.307	4.70	1.83
	31	46	31	11	4	12	.664	50.3	2.624	6.83	3.44
	34	40	27	11	2	12	.112	15.4	2.531	1.20	.18
	36	23	20	2	1	-	-	-	-	-	-
	40	17	2	10	5	11	.137	16.5	2.011	1.84	.30
4C	4	22	18	2	2	-	Trace	-	-	-	-
	6	43	23	18	2	19	.015	11.4	3.800	.11	.01
	8	34	23	9	2	10	.008	16.9	2.000	.11	.02
	10	43	26	15	2	16	.012	33.1	3.200	.10	.03
	12	38	25	10	3	-	-	-	-	-	-
	14	35	27	6	2	7	1.781	64.4	1.330	36.16	23.28
	16	30	14	14	2	15	.200	48.3	3.000	1.80	.87

See footnotes at end of table.

TABLE 8. - Summary of churn-drilling and shaft-sinking results, Cape Creek (Con.)

Line No.	Hole No.	Drill-hole data					Concentrate		Mining section		
		Depth, feet					Weight, lb.	Tin, per cent	Volume, cu. ft.	Conc., lb. per cu. yd.	Tin, lb. per cu. yd.
		Total	O.B.	Gravel	Bed-rock	M.S.					
4C	18	36	26	9	1	10	2.527	40.8	1.916	35.61	14.53
	20	40	-	38	2	39	6.841	61.2	7.800	23.68	14.49
	22	66	-	41	25	42	1.455	54.1	10.400	3.78	2.04
	24	70	-	32	38	33	.179	24.4	6.600	.73	.18
	26	33	3	23	7	-	-	-	-	-	-
5	6	17	-	16	1	17	.066	48.7	5.216	.34	.17
	8	38	-	36	2	37	1.863	44.6	6.745	7.46	3.33
	12	48	-	40	8	41	1.424	52.4	8.754	4.39	2.30
	14	39	-	37	2	38	.556	49.3	6.909	2.17	1.07
	16	23	-	20	3	-	-	-	-	-	-
5A	13	32	-	29	3	30	4.079	55.0	6.312	17.45	9.59
	14	29	-	27	2	28	3.221	60.2	6.768	12.85	7.74
	15	31	-	30	1	31	2.164	51.0	7.003	8.34	4.26
	17	26	-	24	2	25	.209	63.0	5.555	1.02	.64
	19	18	-	16	2	-	-	-	-	-	-
	21	10	3	6	1	-	-	-	-	-	-
	24	13	3	8	2	-	-	-	-	-	-
	26	14	3	9	2	-	-	-	-	-	-
6	10	31	-	29	2	30	1.230	62.3	7.152	4.64	2.89
	14	43	-	42	1	43	1.014	59.3	9.937	2.76	1.63
	17	36	-	35	1	36	2.866	.1	9.000	8.60	.01
	20	26	-	25	1	26	.214	1.3	5.333	1.08	.01
	22	14	-	12	2	-	-	-	-	-	-
6A	7	21	-	19	2	20	.445	59.9	4.012	3.00	1.79
	10	42	-	40	2	-	-	-	-	-	-
	13	32	-	30	2	-	-	-	-	-	-
	15	28	-	26	2	-	-	-	-	-	-
17	10	82	64	16	2	-	-	-	-	-	-
	12	111	65	42	4	43	.924	17.5	8.209	3.04	.53
	14	106	64	36	6	37	.485	13.3	6.582	1.99	.26
	16	99	68	28	3	-	-	-	-	-	-
	18	92	66	22	4	-	-	-	-	-	-
	20	71	58	10	3	-	-	-	-	-	-
	23	65	53	10	2	-	-	-	-	-	-
	27	61	54	5	2	-	-	-	-	-	-

See footnotes at end of table.

TABLE 8. - Summary of churn-drilling and shaft-sinking results, Cape Creek (Con.)

Line No.	Hole No.	Drill-hole data					Concentrate		Mining section		
		Depth, feet					Weight, lb.	Tin per cent	Volume, cu. ft.	Conc., lb. per cu. yd.	Tin, lb. per cu. yd.
		Total	O.B.	Gravel	Bed-rock	M.S.					
18	1+25E	55	18	30	7	-	-	-	-	-	-
	2	133	67	63	3	64	2,630	0.4	12.467	5.70	0.02
	4	107	40	64	3	65	.331	.3	12.565	.71	Trace
	6	90	38	51	1	52	.185	1.2	9.994	.50	.01
	8	94	30	62	2	-	-	-	-	-	-
	10	104	33	68	3	69	1,724	.07	13.800	3.37	Trace
	12	100	33	66	1	67	.143	.57	13.400	.29	Do.
	14	84.5	23	61	0.5	-	-	-	-	-	-
19	1	41	15	23	3	-	-	-	-	-	-
	4	102	69	31	2	-	-	-	-	-	-
	6	102	41	58	3	-	Trace	8.5	-	-	Trace
	8	103	75	27	1	-	-	-	-	-	-
	10	99	62	35	2	-	-	-	-	-	-
	12	67	50	15	2	-	-	-	-	-	-
	16	53	48	2	3	-	-	-	-	-	-
	20	42	40	1	1	-	-	-	-	-	-

Cape Creek shafts

	Shaft No.										
1A	9	9.5	-	9.5	-	-	97.25	(2/)	3/3.772	25.78	-
4	12	8.5	2	6.5	-	-	76.0	(2/)	3/3.245	23.42	-

Drilled by the Bureau of Mines in 1943^{4/}

1A	BM 1	8.5	5.0	2.0	1.5	3.0	54.95		.19	.10
	BM 2	11.0	.0	9.5	1.5	10.5	62.75		1.11	.70
1	BM 1	7.8	5.0	.0	1.8	.0	.00		.00	.00
	BM 2	5.0	.0	3.0	2.0	4.0	54.95		.23	.13
	BM 3	7.5	.0	4.5	2.0	5.5	54.95		.55	.30
	BM 4	10.0	.0	8.5	1.5	9.5	62.75		1.80	1.13
	BM 5	18.0	2.5	14.5	1.0	15.5	62.75		3.74	2.35
	BM 6	20.5	2.5	17.0	1.0	18.0	54.95		.39	.21
2	BM 1	13.0	3.0	8.0	2.0	9.0	54.95		.23	.13
	BM 2	17.5	8.5	7.5	1.5	8.5	62.75		24.82	15.57
	BM 3	19.5	12.5	4.5	2.5	5.5	62.75		6.69	4.20
	BM 4	20.0	3.0	16.0	1.0	17.0	54.95		.38	.21

See footnotes at end of table.

TABLE 8. - Summary of churn-drilling and shaft-sinking results, Cape Creek (Con.)

Line No.	Hole No.	Drill-hole data					Concentrate		Mining section		
		Depth, feet					Weight, lb.	Tin per-cent	Volume, cu. ft.	Conc., lb. per cu. yd.	Tin, lb. per cu. yd.
		Total	O.B.	Gravel	Bed-rock	M.S.					
3	BM 1	25.0	3.0	21.0	1.0	22.0		54.95		0.42	0.23
	BM 2	24.0	4.0	18.5	1.5	19.5		54.95		.37	.20
	BM 3	24.2	2.0	22.0	.2	23.0		62.75		.53	.33
4	BM 4	35.0	3.5	7.0	<u>5</u> /24.5	8.0		62.75		2.87	1.80
	BM 5	22.0	1.0	5.0	<u>5</u> /16.0	6.5		54.95		.83	.46
5	BM 1	16.5	.0	15.5	1.0	16.5		54.95		.42	.23
	BM 2	14.5	4.5	7.5	2.5	8.5		62.75		1.99	1.25
	BM 3	14.0	3.0	9.5	1.5	10.5		62.75		1.04	.65
	BM 4	16.5	3.5	8.5	4.5	12.0		62.75		1.11	.70
	BM 5	13.5	4.0	8.0	1.5	9.0		54.95		.27	.15
6	BM 1	20.0	4.5	14.0	1.5	15.0		62.75		2.64	1.65
	BM 2	23.2	3.5	17.5	2.2	18.5		62.75		3.28	2.06
	BM 3	13.5	7.0	5.5	1.0	6.5		54.95		.33	.18

1/ Estimated.

2/ No analyses.

3/ Cubic yards.

4/ Drilled with 4-inch casing and corresponding-size tool string.

5/ Clay "bedrock."

Cape Creek Beach

The Cape Creek Beach deposit is contained partly in stream gravels and partly in beach sands. Except for the top few feet, it remains permanently frozen to the present strand line on the beach. This deposit differs from the other deposits in that it contains finer and more rounded sand and gravel and much less muck and ice.

Figure 24 shows the Cape Creek Beach deposit. Sample data are summarized in table 10.

Boulder Creek

The Boulder Creek deposit occurs at the base of Cape Mountain where Boulder Creek emerges from a narrow, rocky valley onto the coastal plain. Much of the deposit lies in coarse, unconsolidated, thawed gravels spotted with granite boulders 3 to 5 feet or more in diameter. Inherently, churn-drill samples from ground of this type are less accurate than those from frozen gravels or consolidated, uniform size, unfrozen gravels.

TABLE 9. - Summary of churn-drilling and shaft-sinking results, First Chance Creek

Line No.	Hole No.	Drill-hole data					Concentrate		Mining section		
		Depth, feet					Weight, lb.	Tin, per cent	Volume, cu. ft.	Conc., lb. per cu. yd.	Tin, lb. per cu. yd.
		Total	O.B.	Gravel	Bed-rock	M.S.					
A	5	17	3	12	2	-	Trace	-	-	-	Trace
	7	17	2	14	1	15	0.080	66.3	4.602	0.47	0.31
	9	19	1	16	2	17	.101	57.9	5.216	.52	.30
4	7	14	1	10	3	11	.295	32.8	3.375	2.36	.83
	9	10	2	6	2	-	-	-	-	-	-
4A	C3	16	1	11	4	-	-	-	-	-	-
4B	4	10	-	8	2	-	-	-	-	-	-

Drilled by Bureau of Mines in 1943

2	BM 4	13.0	6.0	4.0	3.0	5.0	-	62.25	-	1.55	.96
	BM 5	9.5	3.0	4.0	2.5	5.0	-	62.25	-	1.01	.63
3	BM 4	9.2	2.5	5.5	1.2	6.5	-	62.25	-	2.22	1.38
	BM 6	7.2	2.0	3.0	2.2	4.0	-	62.25	-	1.83	1.14
4	BM 3	9.0	1.5	5.0	2.5	6.0	-	62.25	-	1.73	1.08
	BM 4	9.2	3.5	5.0	.7	6.0	-	62.25	-	4.34	2.70

Shaft data^{1/}

	Shaft No.								Cu. yd.		
1	15	10.0	(2/)	-	-	-	-	-	-	-	-
	18	10.0	(2/)	-	-	-	-	-	-	-	-
2	4	7.0	1.0	6.0	-	(2/)	5.038	-	2.055	2.45	-
	5	14.0	1.0	13.0	-	14.0	12.981	-	6.264	2.07	-
3	4	9.5	1.5	8.0	-	9.0	7.282	-	2.775	2.62	-
	6	7.0	(2/)	-	-	-	-	-	-	-	-
4	3	10.5	-	10.5	-	11.5	15.860	-	4.472	3.55	-
	4	10.0	1.0	9.0	-	10.0	11.595	-	3.158	3.67	-

^{1/} Data from field logs; results of analyses not available.

^{2/} Incomplete.

TABLE 10. - Summary of Cape Creek Beach churn-drilling results

Line No.	Hole No.	Drill-hole data					Concentrate		Mining section		
		Depth, feet					Weight, lb.	Tin, per cent	Volume, cu. ft.	Conc., lb. per cu. yd.	Tin, lb. per cu. yd.
		Total	O.B.	Gravel	Bed-rock	M.S.					
Z24	2	15	4	8	3	9	0.033	11.3	2.761	0.323	0.04
	4	20	0	17	3	18	.185	16.6	5.522	.905	.15
	8	27	18	7	2	8	.600	3.3	2.454	6.601	.22
	10	14	1	10	3	-	-	-	-	-	-
Z14	3	31	4	26	1	-	-	-	-	-	-
	5	22	5	15	2	16	.600	3.3	4.909	3.300	.11
	7	21	3	16	2	17	1.107	3.8	5.216	5.730	.22
	10	20	3	15	2	16	3.219	3.9	4.909	17.705	.69
	12	15	0	12	3	13	4.356	4.1	3.988	29.491	1.21
	15	29	0	26	3	27	4.431	3.7	8.284	14.442	.53
	19	31	3	26	2	27	3.029	1.4	5.443	15.025	.21
	23	27	5	20	2	21	.613	1.8	4.236	3.907	.07
	27	26	5	19	2	20	.300	14.6	4.132	1.960	.29
	31	28	17	9	2	10	.020	7.7	2.061	.261	.02
Z10	4	19	4	14	1	-	-	-	-	-	-
	6	17	3	13	1	14	.558	.95	4.295	3.508	.03
	8	16	-	15	1	16	1.224	3.3	4.909	6.732	.22
	12	12	-	10	2	11	.891	2.5	3.375	7.128	.18
	16	16	3	11	2	12	.397	5.0	2.443	4.387	.22
	20	16	-	14	2	15	1.327	3.0	4.602	7.786	.23
	28	19	-	18	1	19	.851	2.3	4.001	5.743	.13
	30	18	1	15	2	16	.106	4.4	2.933	.976	.04
	32	18	2	15	1	16	.029	3.7	2.928	.267	.01
Z8	34	14	-	12	2	13	.176	7.0	3.988	1.192	.08
Z6	10	12	-	10	2	11	1.499	1.2	3.375	11.992	.14
	14	16	-	14	2	15	.223	10.3	4.602	1.308	.13
	18	15	-	13	2	14	.099	8.5	4.295	.622	.05
	22	14	-	13	1	14	.053	9.6	4.295	.333	.03
	24	15	-	13	2	14	.299	1.8	4.295	1.880	.03
	26	14	-	12	2	13	.295	4.4	3.988	1.997	.09
	30	13	-	11	2	12	.520	3.0	3.682	3.813	.11
	34	14	-	12	2	13	4.352	1.1	3.988	29.464	.32
	38	14	-	11	3	12	1.799	.95	3.682	13.192	.13
	40	13	-	11	2	12	.496	2.9	3.682	3.637	.11
	42	13	-	11	2	12	.209	2.4	3.682	1.533	.04
	46	15	-	13	2	14	.287	4.5	4.295	1.804	.08
	50	20	-	12	8	-	.011	-	-	-	< .01
	54	19	-	17	2	18	.044	11.0	5.522	.215	.02
	58	19	-	17	2	-	Trace	-	-	-	< .01

TABLE 10. - Summary of Cape Creek Beach churn-drilling results (Con.)

Line No.	Hole No.	Drill-hole data					Concentrate		Mining section		
		Depth, feet					Weight, lb.	Tin, per cent	Volume, cu. ft.	Conc., lb. per cu. yd.	Tin, lb. per cu. yd.
		Total	O.B.	Gravel	Bed-rock	M.S.					
Z6	62	20	-	18	2	-	Trace	-	-	-	<0.01
	65	30	-	19	11	-	do.	-	-	-	< .01
B25	8	14	-	12	2	13	0.516	3.3	3.988	3.493	.12
	10	14	-	12	2	13	.494	1.8	3.988	3.345	.06
	12	14	-	12	2	13	.298	1.9	2.906	2.769	.05
	14	22	-	14	8	15	.079	2.0	3.353	.636	.01
	16	16	3	12	1	-	-	-	-	-	-
	20	18	2	14	2	15	6.680	3.3	4.602	39.192	1.29
	24	18	2	14	2	15	.811	2.1	2.927	7.481	.16
	28	23	2	20	1	21	.785	5.1	4.467	4.745	.24
	32	21	3	17	1	18	1.019	.7	3.524	7.807	.05
	36	26	3	21	2	22	.448	1.6	4.737	2.554	.04
	40	25	6	17	2	18	.320	3.1	4.343	1.989	.06
B45	6	15	-	13	2	14	.053	3.9	4.295	.333	.01
	8	13	-	11	2	-	-	-	-	-	-
	10	13	-	11	2	12	.229	5.8	3.682	1.679	.10
	11	13	-	11	2	12	.547	4.4	3.682	4.011	.18
	12	12	-	10	2	11	.157	2.6	3.375	1.256	.03
	14	13	-	11	2	12	.031	18.4	3.682	.227	.04
	18	14	3	10	1	-	-	-	-	-	-
	22	17	8	7	2	-	-	-	-	-	-
	26	25	11	11	3	12	.015	52.3	2.583	.157	.08
	30	23	9	12	2	-	-	-	-	-	-
	34	23	10	10	3	-	-	-	-	-	-
	38	22	3	17	2	-	-	-	-	-	-
B65	42	29	2	25	2	-	-	-	-	-	-
	8	16	-	15	1	16	1.169	.1	4.909	6.430	< .01
	10	19	-	15	4	16	.403	2.4	4.909	2.217	.05
	12	17	-	15	2	16	.029	7.1	4.909	.160	.01
	14	18	-	16	2	-	-	-	-	-	-
	18	22	-	20	2	-	-	-	-	-	-
	22	23	13	9	1	-	-	-	-	-	-
	26	30	19	9	2	-	-	-	-	-	-
	30	36	2	32	2	-	-	-	-	-	-

The upper and lower limits of exploration were fixed at points beyond which the value of the deposit decreased sharply. Below Zenda line 88 the grade of tin mineralization drops markedly (see fig. 25). Holes 16 to 30 on Zenda line 88 penetrated an ancient beachline; water-rounded pebbles and fragments of seashells were recovered from depths of 25 to 35 feet. Wave action on the beach may have been responsible for much of the dispersion of

mineralization noted in this deposit. Some tin undoubtedly occurs in the gravels of the Boulder Creek valley upstream from the area drilled; however, the valley above BM line 1 is choked with boulders and slide rock from the surrounding slopes, and any deposited there could be recovered only at prohibitive cost.

The limestone-granite contact underlies the deposit between BM line 1 and Zenda line 106; downstream the bedrock is limestone. Hole 22 on Zenda line 94 penetrated 55 feet of fractured limestone bedrock; a sample from the bottom 46 feet indicated 0.025 percent tin in the bedrock. The cassiterite occurred in a gangue of limestone with some iron oxide.

Figures 25 through 37 show the Boulder Creek deposit. Tables 11 and 12 give petrographic, radiometric, and spectrographic analyses of seven samples of churn-drill concentrates representing a section across the pay horizon. Drill-hole data and tin analyses are summarized in table 13.

TABLE 11. - Petrographic analyses of 7 churn-drill concentrates, line 94, Boulder Creek, percent¹/

	Line 94, hole 24	Line 94, hole 26	Line 94, hole 28	Line 94, hole 32	Line 94, hole 34	Line 94, hole 36	Line 94, hole 38
Cassiterite...	40	35	40	50	45	70	20
Calcite.....)	35	35 (	-	5	) 10 (	-	-
Dolomite.....)			-	-	) 2 (	2	1
Quartz.....	20	25	40	25	25	<u>5</u> /20	45
Augite.....	3	-	-	-	-	-	-
Diopside.....	-	2	10	<u>2</u> /12	<u>4</u> /5	-	<u>6</u> /15
Clay.....	-	-	) (	3	5	4	5
Shale.....	-	-	) 10 (	-	-	-	-
Feldspar.....	-	1	) (	<u>3</u> /5	8	-	10
Epidote.....	-	) (	-	-	-	Trace	-
Biotite.....)	(	) 1 (	Trace	-	1	1	<u>7</u> /2
Garnet.....)	(	1	do.	-	Trace	1	1
Tourmaline....	1	-	do.	Trace	-	1	1
Chlorite.....	-	-	do.	-	-	-	-
Hornblende....	-	-	-	-	1	-	Trace
Hematite.....	-	-	-	-	-	1	-
Staurolite....	-	-	-	-	-	Trace	-
Scheelite.....	Trace	Trace	Trace	Trace	Trace	do.	Trace
Zircon.....	-	do.	-	-	do.	-	-
Monazite.....	Trace	do.	-	Trace	do.	Trace	Trace
Xenotime.....	-	-	-	do.	do.	do.	Do.
Apatite.....	-	-	-	-	-	-	Do.

1/ No gold or silver detected in any samples. Chemical tests indicated that tungsten, columbium, tantalum, and yttrium present in minor amounts to traces in all 7 samples, columbium and tantalum being somewhat more abundant in samples from holes 32 and 36.

2/ Including garnet and epidote.

3/ Including biotite.

4/ Including epidote.

5/ Including feldspar.

6/ Including augite and epidote.

7/ Including chlorite.

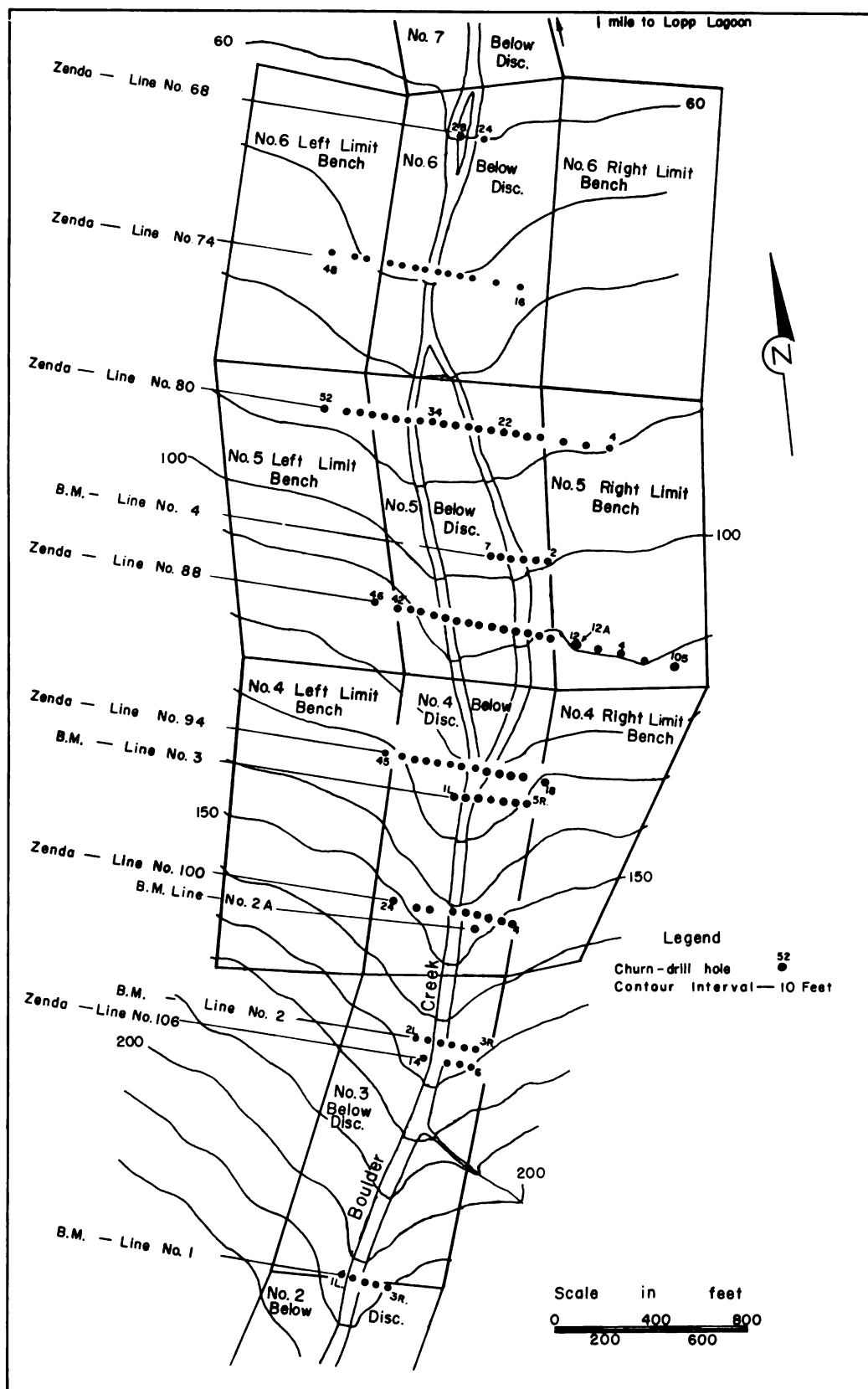


FIGURE 25. - Boulder Creek Churn-Drill Exploration.

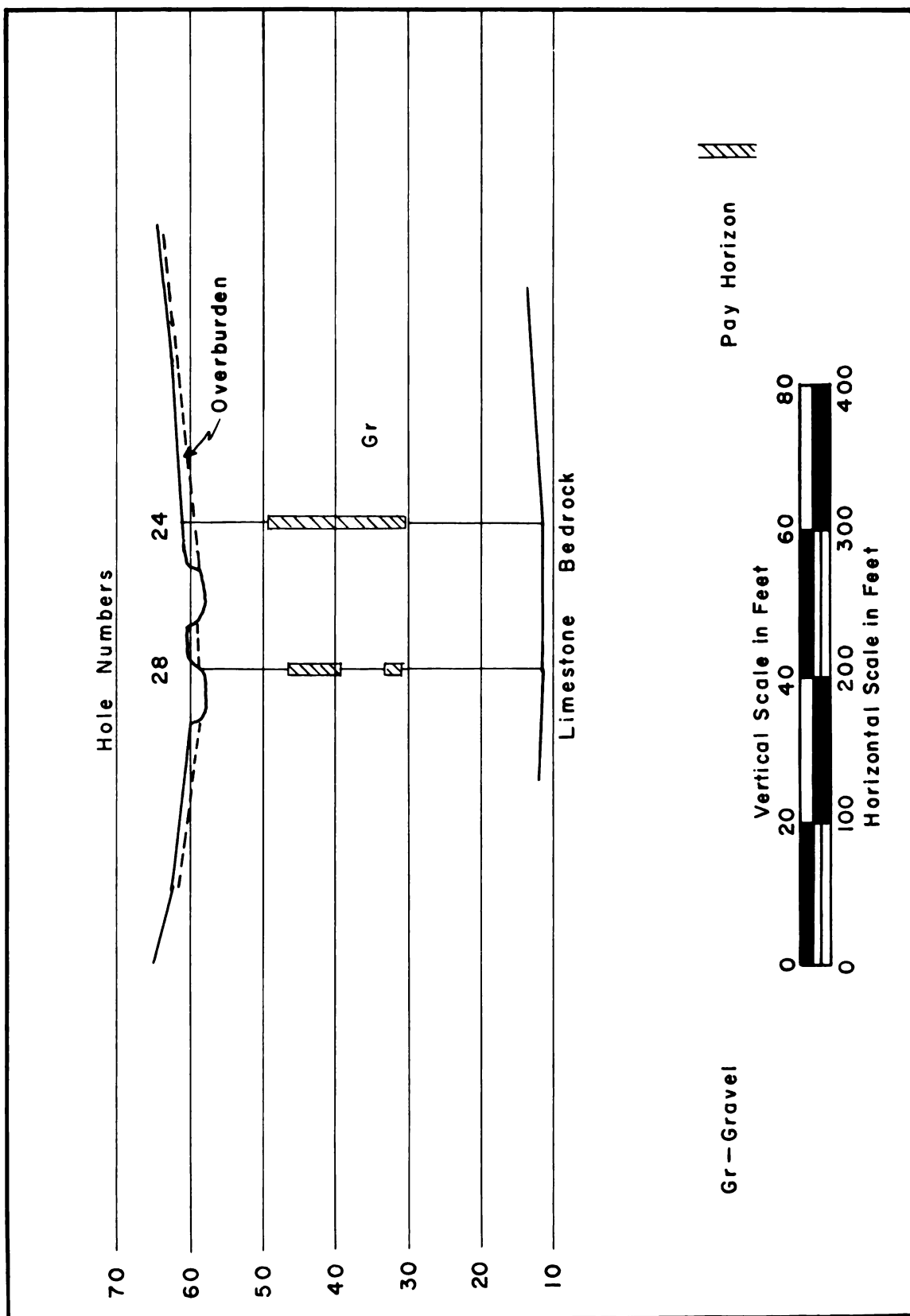


FIGURE 26. - Section on Line 68, Boulder Creek.

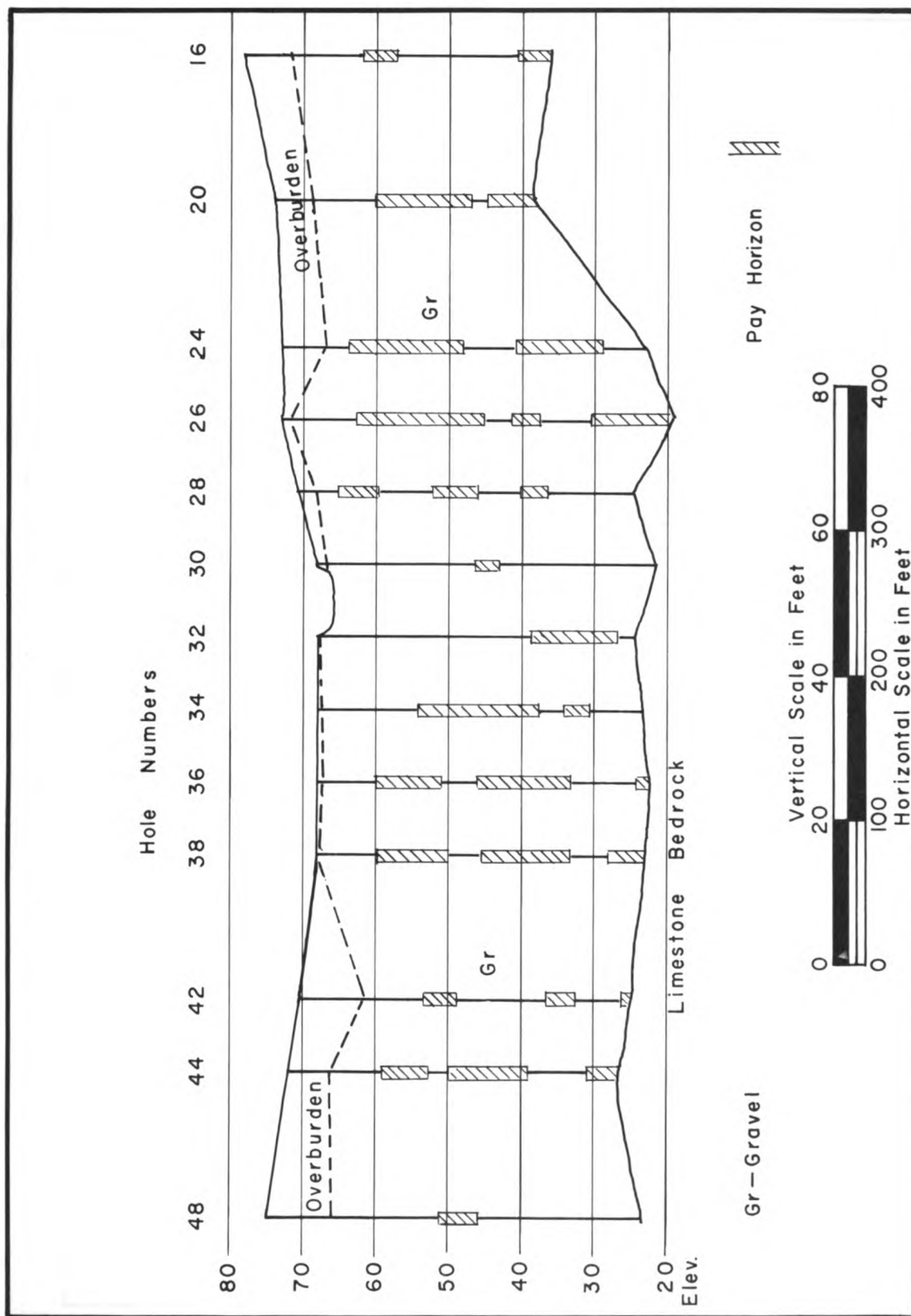


FIGURE 27. - Section on Line 74, Boulder Creek.

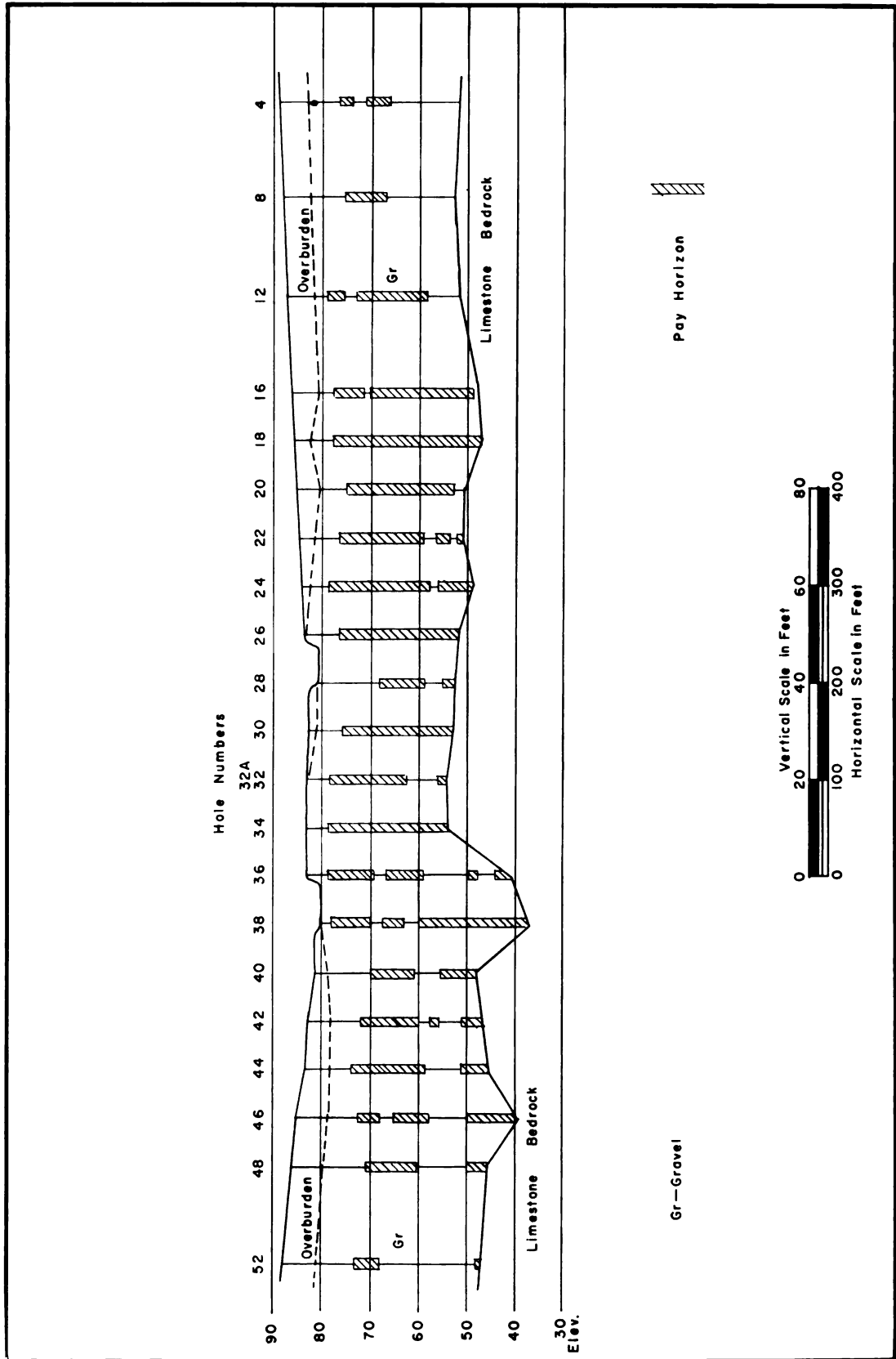


FIGURE 28. - Section on Line 80, Boulder Creek.

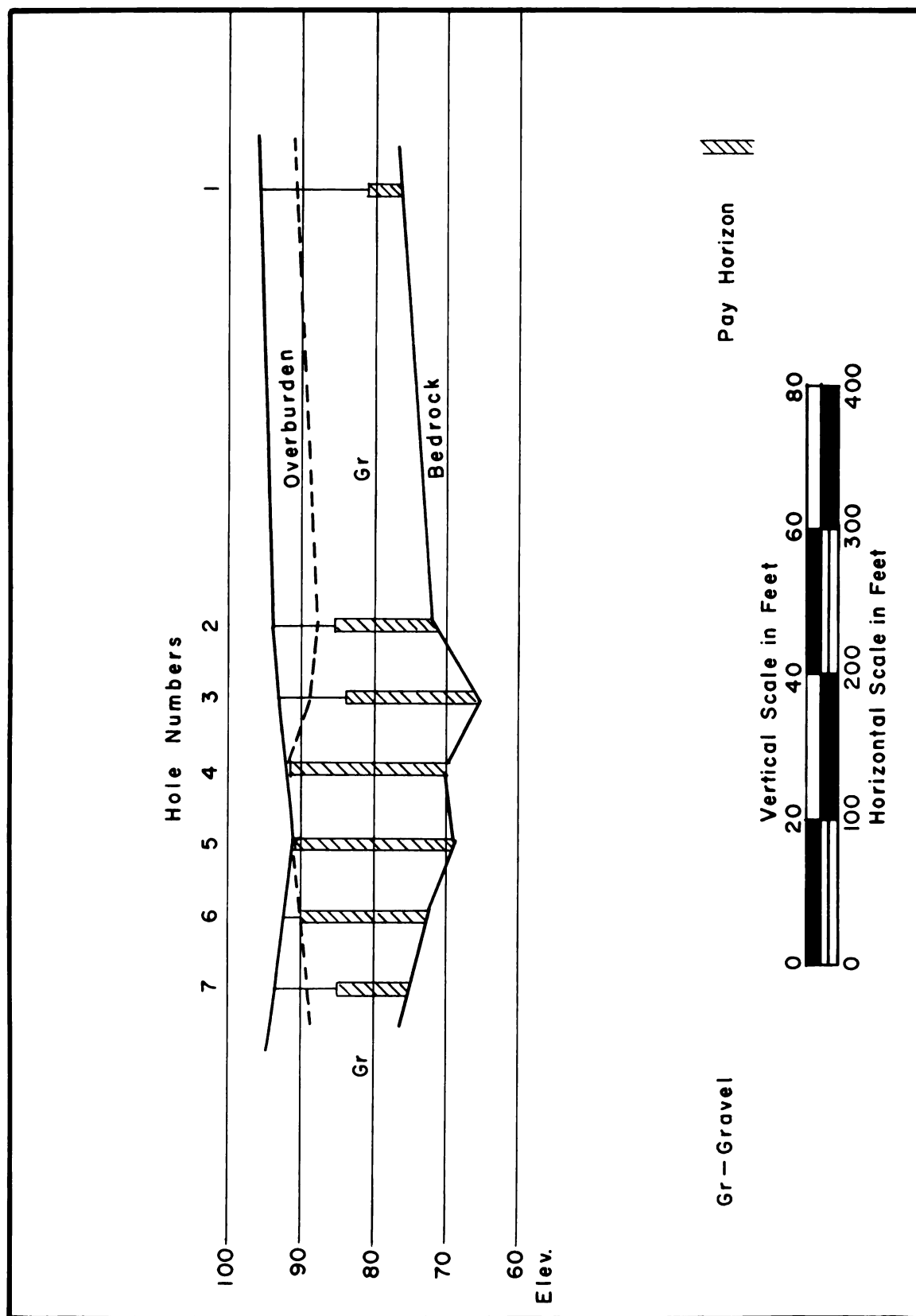


FIGURE 29. - Section on B.M. Line 4, Boulder Creek.

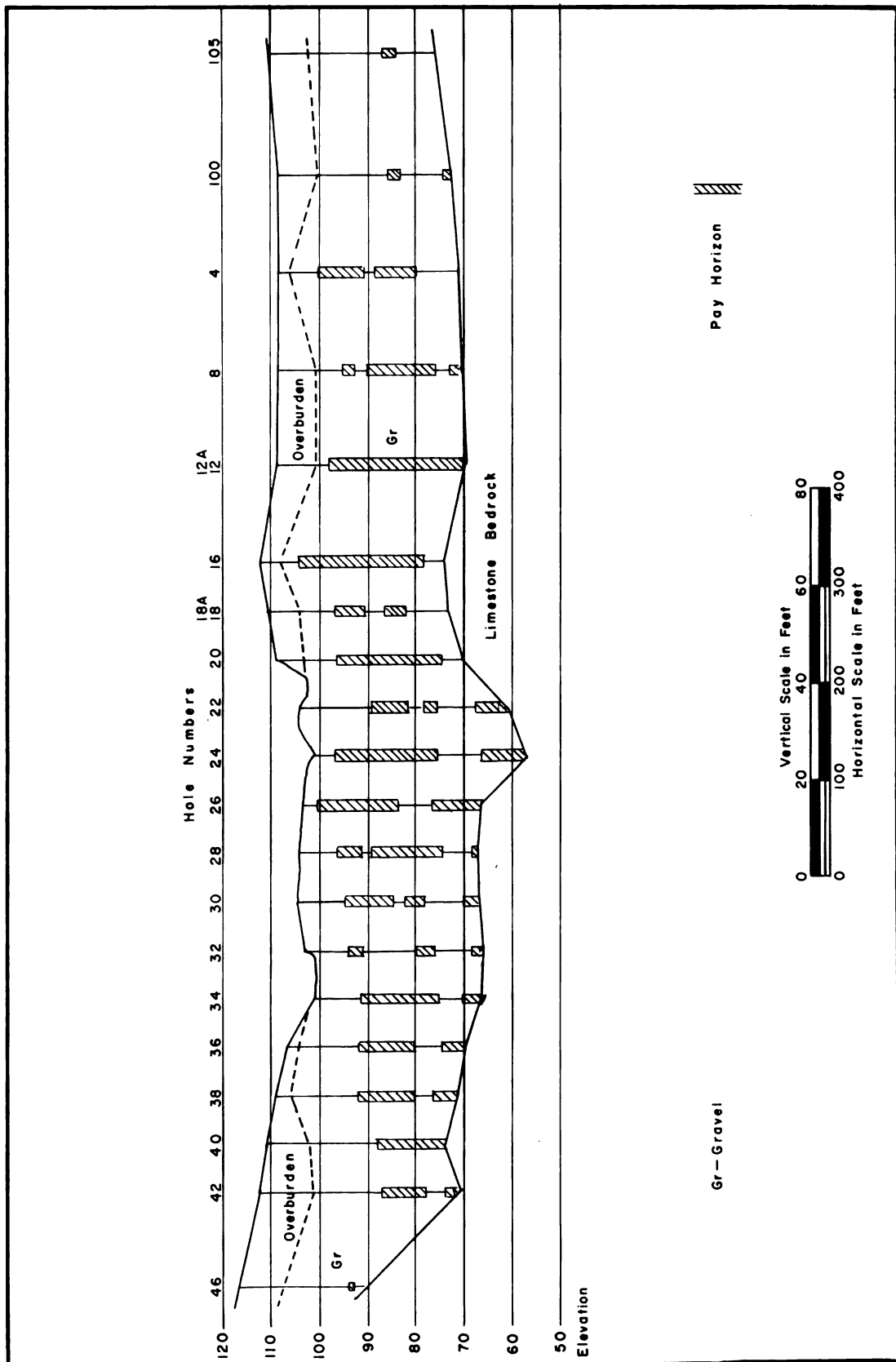


FIGURE 30. - Section on Line 88, Boulder Creek.

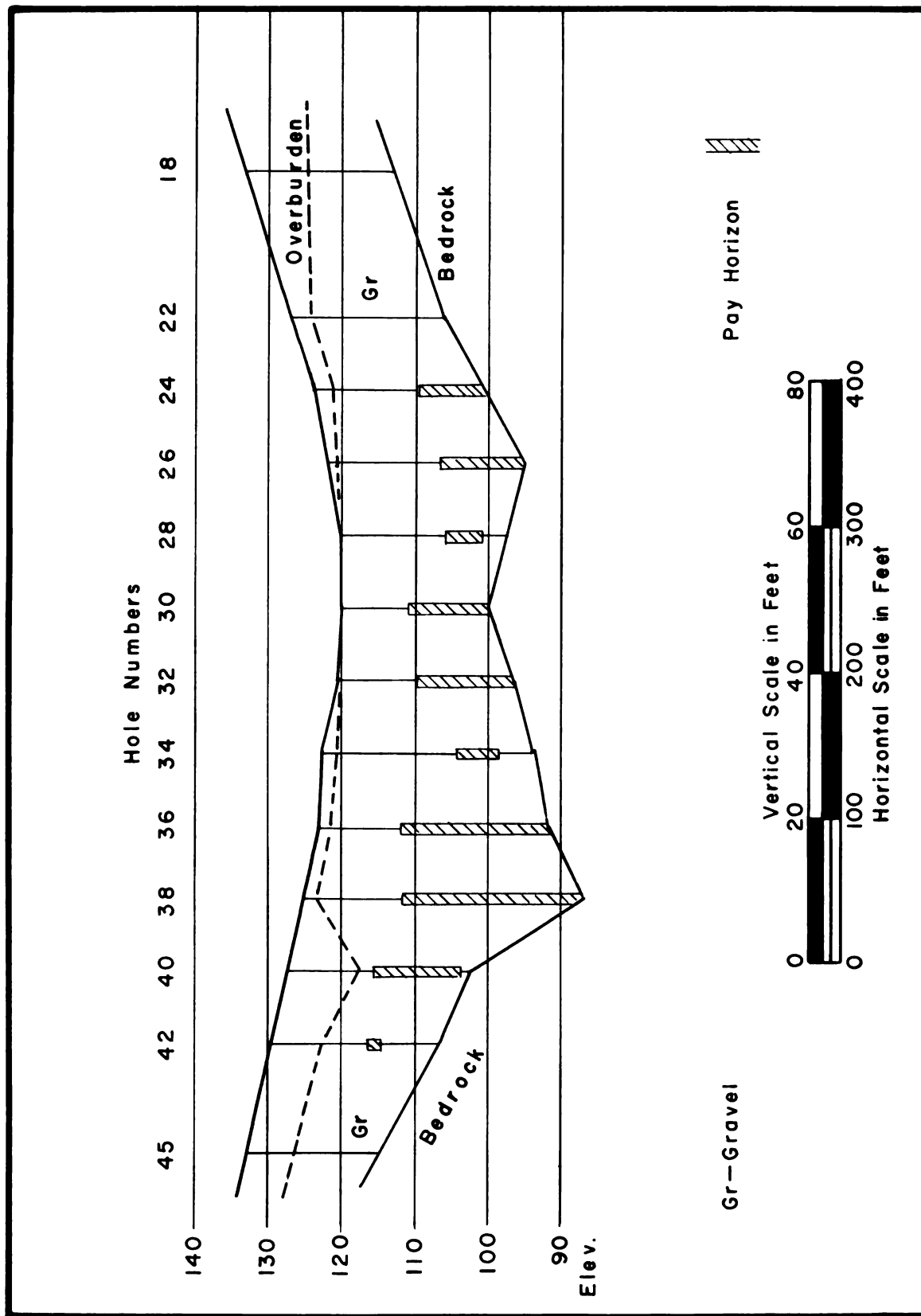


FIGURE 31. - Section on Line 94, Boulder Creek.

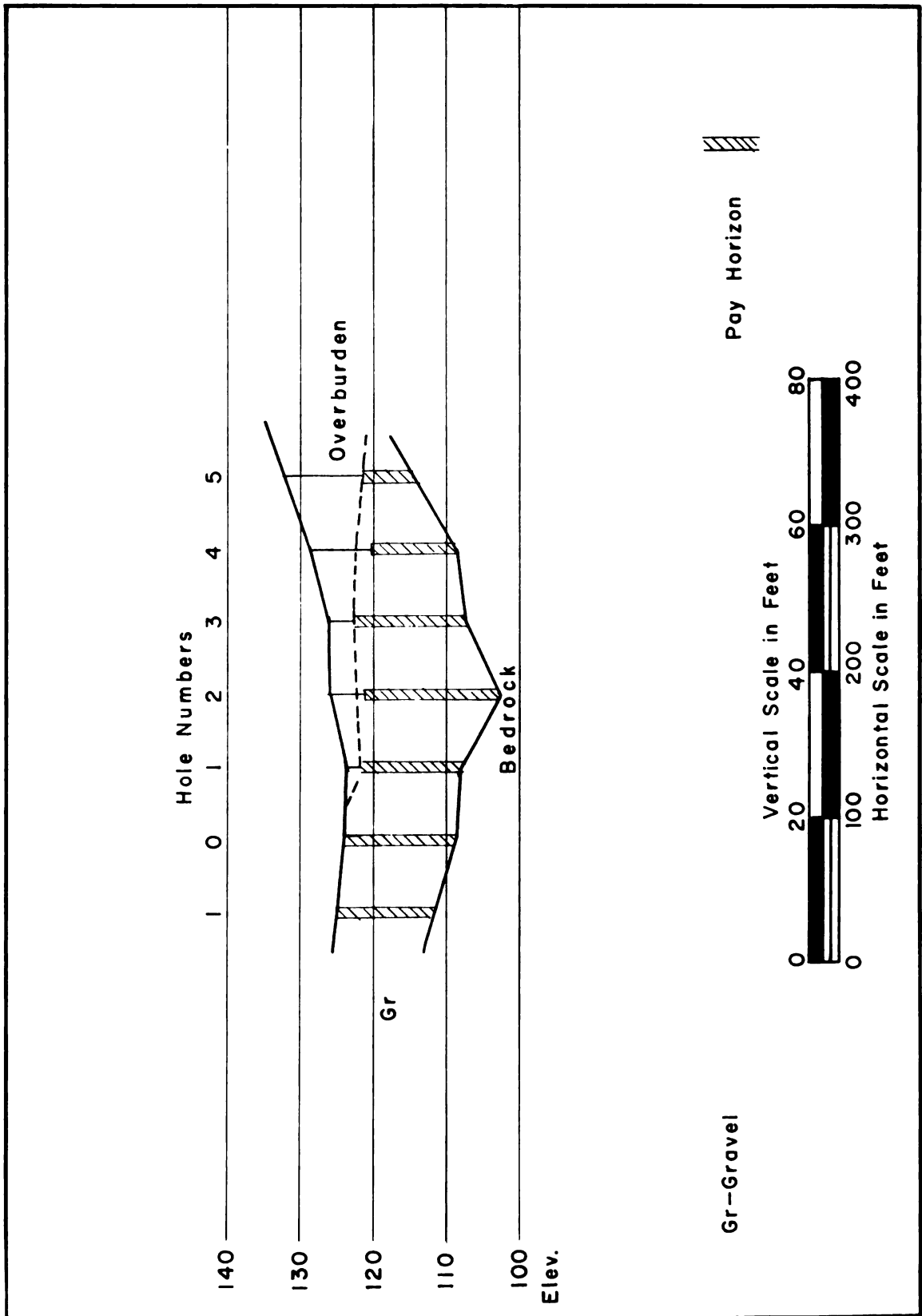


FIGURE 32. - Section on B.M. Line 3, Boulder Creek.

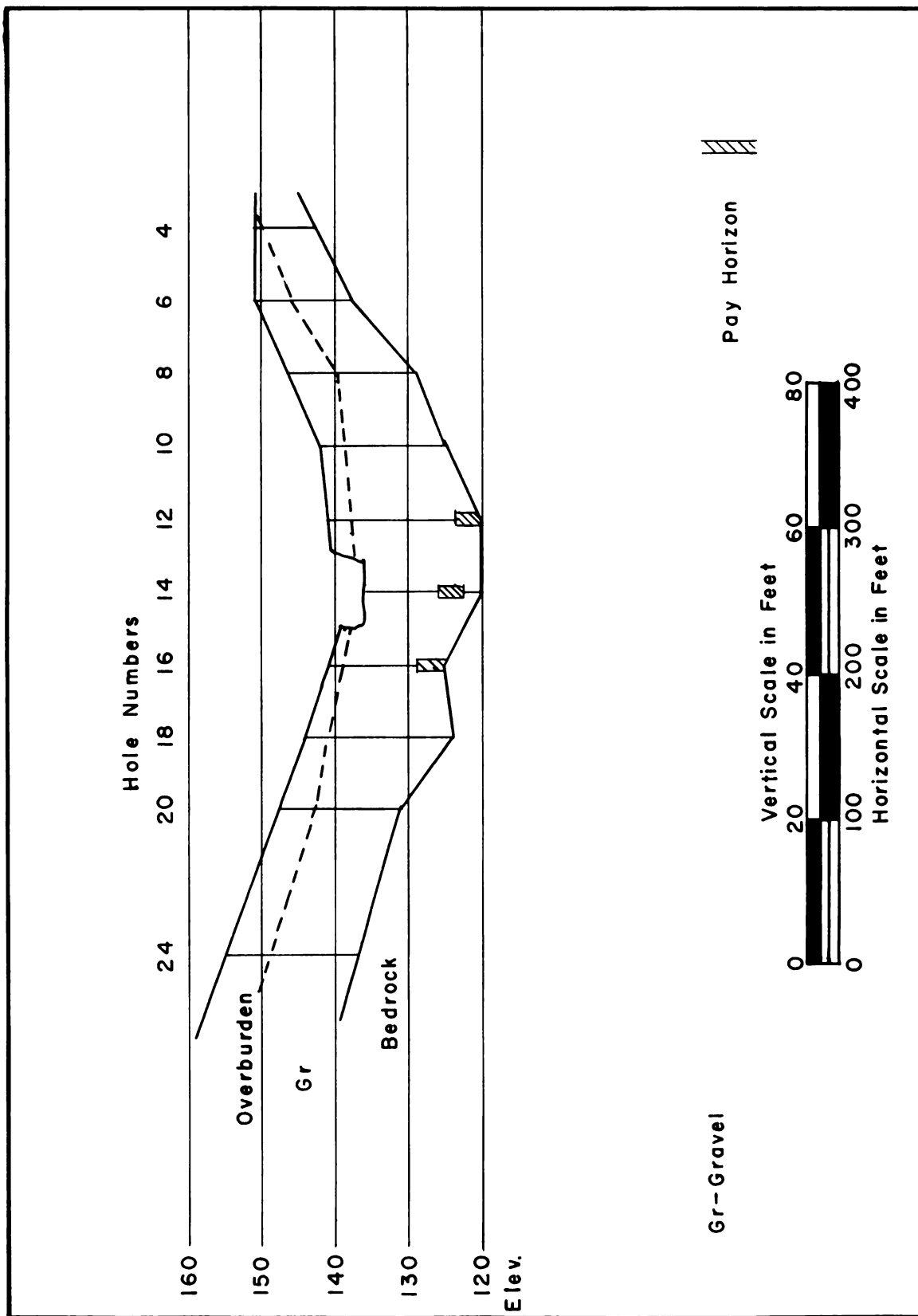


FIGURE 33. - Section on Line 100, Boulder Creek.

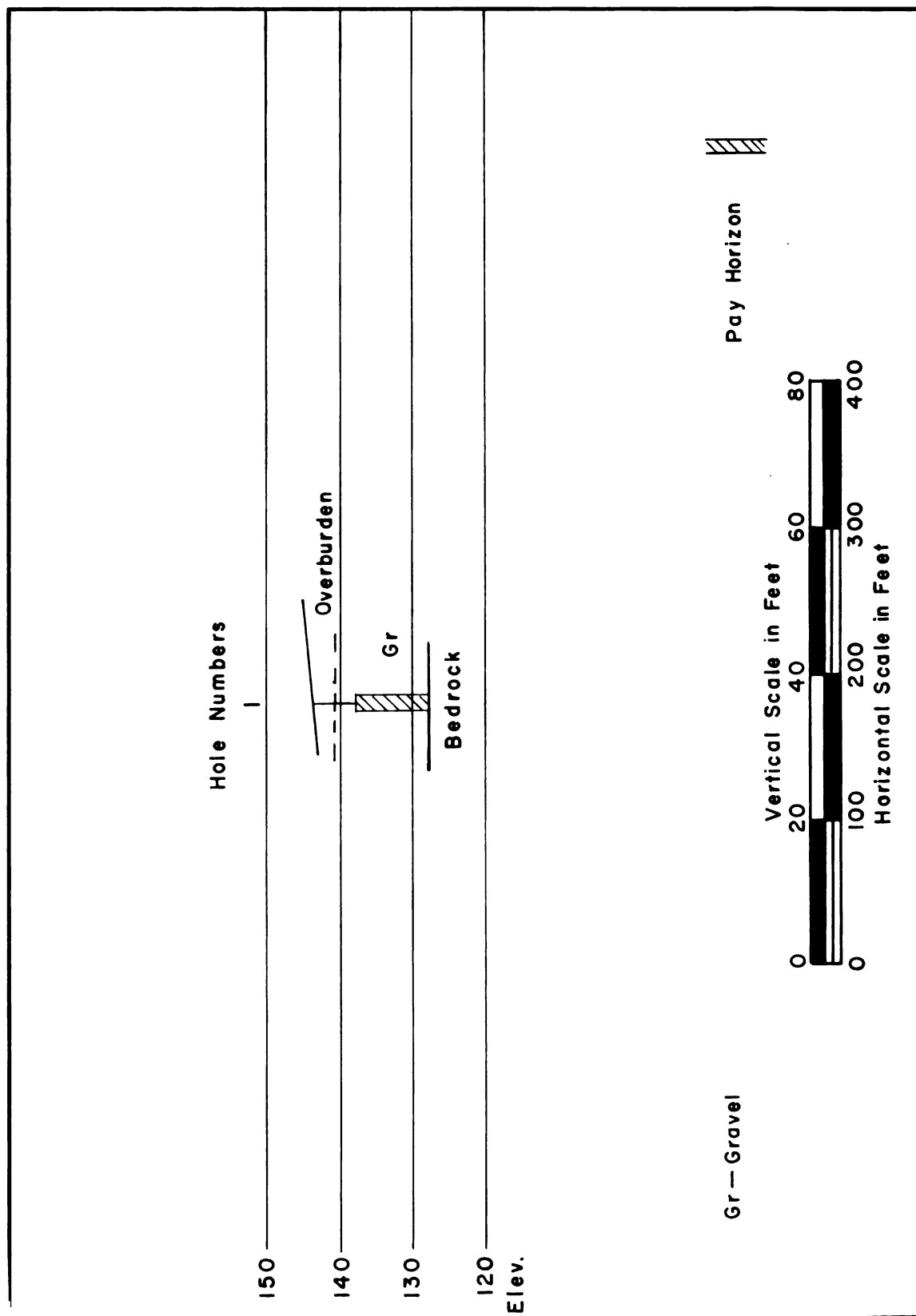


FIGURE 34. - Section on B.M. Line 2A, Boulder Creek.

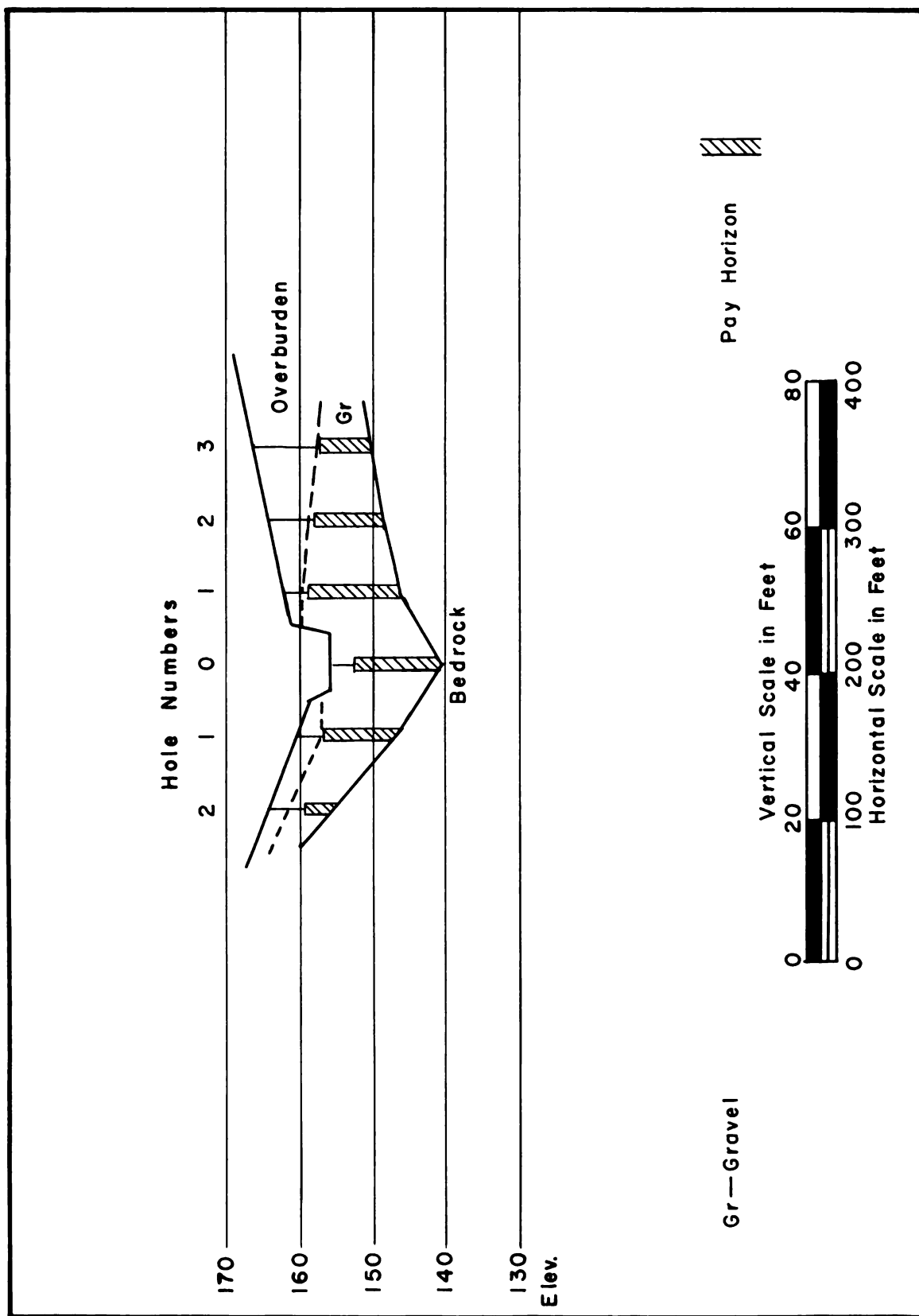


FIGURE 35. - Section on B.M. Line 2, Boulder Creek.

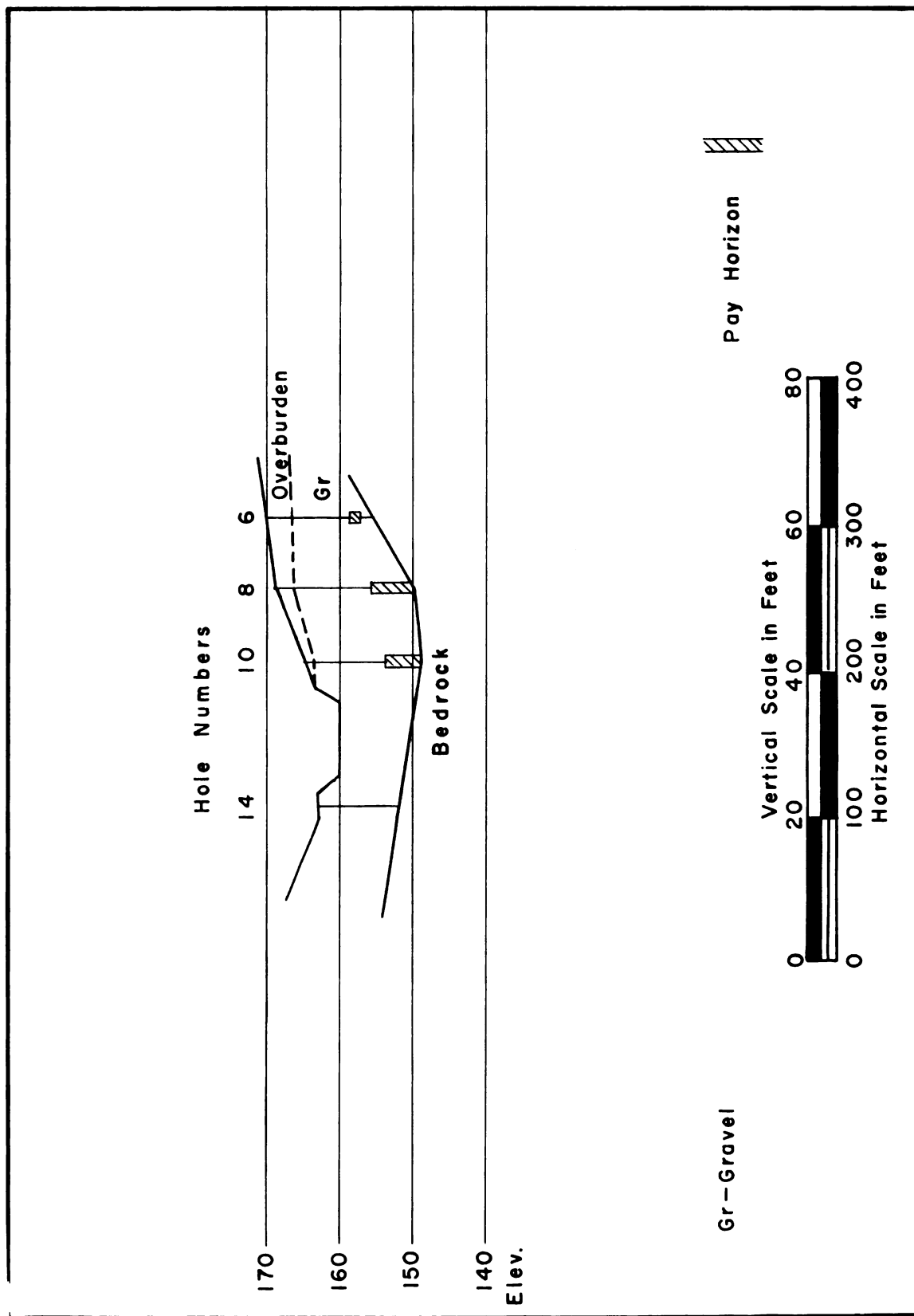


FIGURE 36. - Section on Line 106, Boulder Creek.

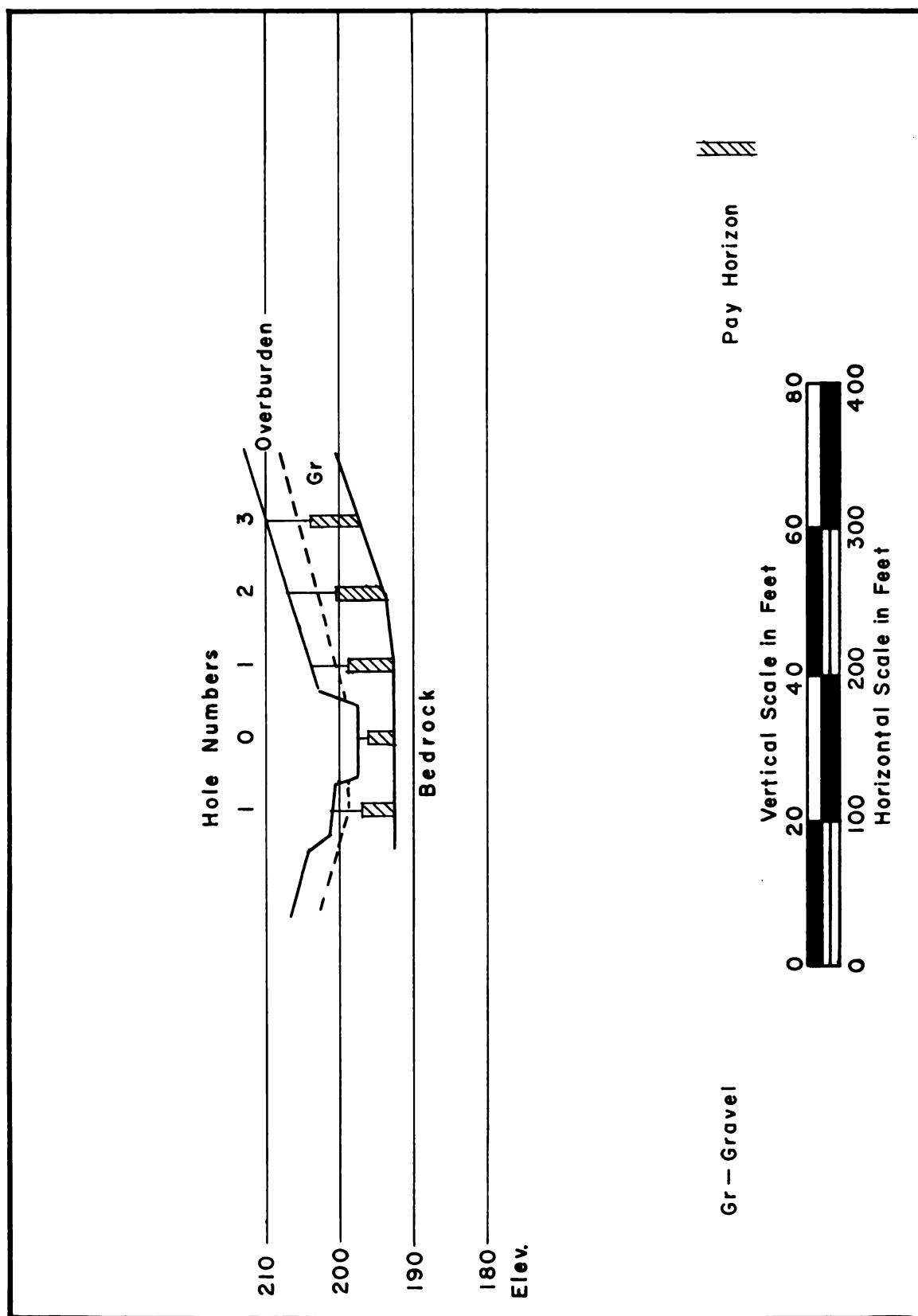


FIGURE 37. - Section on B.M. Line 1, Boulder Creek.

The Boulder Creek concentrates were more radioactive than the concentrates from the Cape Creek drainage; therefore, the equivalent uranium content of the Boulder Creek samples was determined by radiometric analyses. Table 14 summarizes the results.

Radiometric analyses of these seven samples follow:

Line	Hole No.	eU	(or)	eU ₃ O ₈	(or)	eThO ₂
94	24	0.004		0.005		0.020
94	26	.003		.004		.016
94	28	.004		.005		.020
94	32	.007		.008		.032
94	34	.012		.014		.056
94	36	.021		.025		.100
94	38	.005		.006		.024

The amounts of monazite and xenotime in the samples were approximately proportional to their radioactivity. Most of the radioactivity may have been due to thorium, although qualitative chemical tests indicated that traces of uranium are present in all seven samples. The amount of uranium present was too small to permit identification of the mineral in which it occurs.

TABLE 12. - Spectrographic analyses of churn-drill concentrates, line 94, Boulder Creek^{1/}

	<u>Ag</u>	<u>Al</u>	<u>As</u>	<u>Au</u>	<u>B</u>	<u>Ba</u>	<u>Be</u>	<u>Bi</u>	<u>Ca</u>	<u>Cd</u>	<u>Co</u>	<u>Cr</u>	<u>Cu</u>	
Composite, line 94 ^{2/}	-	B	D	-	E	-	F	E	B	-	F	E	F	
	<u>Fe</u>	<u>Ga</u>	<u>Ge</u>	<u>Hg</u>	<u>In</u>	<u>Li</u>	<u>Mg</u>	<u>Mn</u>	<u>Mo</u>	<u>Na</u>	<u>Nb</u>	<u>Ni</u>	<u>P</u>	
Composite, line 94	C	-	-	-	-	-	C	D	F	C	E	E	-	
	<u>Pb</u>	<u>Pd</u>	<u>Pt</u>	<u>Sb</u>	<u>Si</u>	<u>Sn</u>	<u>Sr</u>	<u>Ta</u>	<u>Te</u>	<u>Ti</u>	<u>V</u>	<u>W</u>	<u>Zn</u>	<u>Zr</u>
Composite, line 94	D	-	-	E	A	A	-	-	-	C	E	D	-	E

^{1/} Legend: A Over 10 percent.
 B 5 to 10 percent.
 C 1 to 5 percent.
 D 0.1 to 1 percent.
 E 0.01 to 0.1 percent.
 F 0.001 to 0.01 percent.
 G Under 0.001 percent.
 - Not detected.

^{2/} The composite sample includes representative portions of the concentrates from line 94, holes 24, 26, 28, 32, 34, 36, and 38.

TABLE 13. - Summary of churn-drilling results, Boulder Creek

Line No.	Hole No.	Drill-hole data					Concentrate		Mining section		
		Depth, feet					Weight, lb.	Tin, per cent	Volume, ² / _{cu. ft.}	Conc., lb. per cu. yd.	Tin, lb. per cu. yd.
		Total	O.B.	Gravel	Bed-rock	M.S. ¹ / _l					
68	24	52	1	48	3	49	0.165	50.1	14.114	0.316	0.16
	28	49	-	47	2	48	.079	46.8	14.726	.145	.07
74	16	45	6	36	3	37	.179	48.6	7.807	.619	.30
	20	50	5	34	11	35	.170	36.7	10.738	.427	.16
	24	55	6	44	5	45	.439	40.0	13.806	.859	.34
	26	56	1	53	2	54	.677	19.4	14.650	1.248	.24
	28	50	2	45	3	46	.143	48.0	11.454	.337	.16
	30	50	2	45	3	46	.086	40.5	14.113	.166	.07
	32	47	-	44	3	45	.046	45.5	13.806	.090	.04
	34	48	1	44	3	45	.249	31.3	13.806	.487	.15
	36	48	1	45	2	46	.379	34.6	14.113	.725	.25
	38	47	-	45	2	46	.207	42.0	14.113	.396	.17
	42	48	9	36	3	37	.108	51.0	11.351	.257	.13
	44	50	6	39	5	40	.234	37.5	12.272	.515	.19
	48	57	9	43	5	44	.159	27.9	13.499	.318	.09
80	4	40	6	31	3	32	.073	48.6	9.817	.201	.10
	8	38	5	30	3	31	.106	39.4	9.511	.301	.12
	12	39	6	30	3	31	.282	26.5	9.511	.800	.21
	16	40	5	33	2	34	.545	30.3	10.431	1.411	.43
	18	41	3	36	2	37	.589	28.9	11.351	1.401	.40
	20	36	5	29	2	30	.366	21.4	9.204	1.074	.23
	22	37	3	31	3	32	1.087	17.9	9.817	2.990	.54
	24	37	1	34	2	35	1.206	21.7	10.738	3.032	.66
	26	36	-	33	3	34	1.038	25.2	10.431	2.687	.68
	28	31	1	27	3	28	.631	54.5	8.590	1.983	3/1.08
	30	33	2	28	3	29	.807	37.8	8.897	2.449	.93
	32A	30	-	28	2	29	.540	23.5	8.897	1.639	.39
	34	32	-	29	3	30	1.839	9.5	9.204	5.395	.51
	36	47	-	44	3	45	.536	15.2	13.806	1.048	.16
	38	44	-	43	1	44	.816	9.04	13.499	1.632	.15
	40	39	3	30	6	31	.280	31.4	9.511	.795	.25
	42	39	5	32	2	33	.659	33.2	10.124	1.757	.58
	44	40	5	32	3	33	.326	27.0	10.124	.869	.23
	46	56	6	40	10	41	.657	53.48	12.579	1.410	.75
	48	43	6	34	3	35	.139	43.7	10.738	.350	.15
	52	48	6	39	3	40	.298	45.09	12.272	.656	.30
88	105	37	8	26	3	27	.013	39.7	8.284	.042	.02
	100	39	8	28	3	29	.115	40.1	8.897	.349	.14
	4	40	2	35	3	36	.236	20.0	11.045	.577	.12
	8	40	8	31	1	32	.359	31.7	9.107	1.064	.34
	12A	41	8	31	2	32	.494	28.1	9.818	1.359	.38

See footnotes at end of table.

TABLE 13. - Summary of churn-drilling results, Boulder Creek (Con.)

Line No.	Hole No.	Drill-hole data					Concentrate		Mining section		
		Depth, feet					Weight, lb.	Tin, per cent	Volume, ² / _{cu. ft.}	Conc., lb. per cu. yd.	Tin, lb. per cu. yd.
		Total	O.B.	Gravel	Bed-rock	M.S. ¹ / _{ft.}					
88	16	40	4	34	2	35	0.829	37.5	10.738	2.084	0.78
	18A	40	7	30	3	31	.218	38.5	9.511	.619	.24
	20	40	6	32	2	33	1.351	20.0	10.124	3.603	.72
	22	46	-	44	2	45	2.467	17.3	13.806	4.825	.83
	24	47	-	44	3	45	.664	50.0	13.806	1.299	.65
	26	43	-	40	3	41	.351	51.2	12.579	.753	.39
	28	44	-	40	4	41	.966	40.2	11.536	2.261	.91
	30	40	-	38	2	39	.624	55.1	12.168	1.385	.76
	32	40	-	37	3	38	.205	59.5	11.658	.475	.28
	34	39	1	34	4	35	.395	53.5	10.738	.993	.53
	36	40	3	35	2	36	.505	54.4	11.045	1.235	.67
	38	41	3	35	3	36	.326	58.5	11.045	.797	.47
	40	42	9	28	5	29	.523	62.2	8.897	1.587	.99
	42	43	11	30	2	31	.218	39.3	9.511	.619	.24
	46	29	10	15	4	16	.024	52.4	4.909	.132	.07
94	18	27	8	12	7	-	-	-	-	-	-
	22	76	2	19	55	-	-	-	-	-	-
	24	28	3	21	4	22	.525	42.8	6.750	2.100	.90
	26	30	1	26	3	27	.368	31.9	6.122	1.623	.52
	28	27	0	22	5	23	2.390	43.5	7.056	9.145	3.98
	30	25	0	20	5	21	.476	38.2	6.443	1.995	.76
	32	31	1	23	7	24	.364	50.1	7.363	1.335	.67
	34	31	2	25	4	26	.635	22.3	7.977	2.149	.48
	36	35	1	30	4	31	.516	40.6	9.511	1.465	.59
	38	41	1	37	3	38	2.161	16.4	11.658	5.005	.82
	40	28	10	15	3	16	.156	51.6	4.909	.858	.44
	42	26	7	16	3	17	.024	39.2	5.216	.124	.05
100	45	24	6	12	6	-	-	-	-	-	-
	4	9	1	6	2	-	-	-	-	-	-
	6	15	5	8	2	-	-	-	-	-	-
	8	20	6	11	3	-	-	-	-	-	-
	10	19	3	14	2	-	-	-	-	-	-
	12	24	3	18	3	19	1.118	53.4	5.829	5.178	2.76
	14	21	0	16	5	17	.066	57.4	5.216	.342	.20
	16	19	2	14	3	15	.165	61.5	4.602	.968	.60
	18	23	2.5	17.5	3	-	-	-	-	-	-
	20	27	5	12	10	-	-	-	-	-	-
106	24	20	6	12	2	-	-	-	-	-	-
	6	17	3	10	4	11	.007	34.9	3.375	.056	.02
	8	23	2	17	4	18	.130	64.9	5.522	.635	.41
	10	24	2	15	7	16	.251	51.3	4.909	1.381	.71
	14	14	2	8	4	-	-	-	-	-	-

See footnotes at end of table.

TABLE 13. - Summary of churn-drilling results, Boulder Creek (Con.)

Drill-hole data							Concentrate		Mining section		
Line No.	Hole No.	Depth, feet					Weight, lb.	Tin, per cent	Volume, ^{2/} cu. ft.	Conc., lb.per cu.yd.	Tin, lb.per cu.yd.
		Total	O.B.	Gravel	Bed-rock	M.S. ^{1/}					
Bureau of Mines ^{4/}											
4	BM 1	20.2	5	14.2	1.0	15	0.035	46.45	2.25	0.42	0.20
	BM 2	22.3	6	15.6	.7	17	.057	46.45	2.55	.60	.28
	BM 3	27.0	4	23.0	.0	23	.108	59.77	3.45	.84	.50
	BM 4	23.5	-	21.0	2.5	22	.288	59.77	3.30	2.35	1.40
	BM 5	21.5	-	21.5	-	21.5	.204	59.77	3.23	1.70	1.02
	BM 6	19.5	2	17.5	-	18.5	.163	59.77	2.78	1.58	.94
	BM 7	18.6	4	14.0	.6	15	.133	59.77	2.25	1.59	.95
3	BM 5RL	19.5	10.5	7	2.0	8	.041	46.45	1.20	.92	.43
	BM 4RL	21.5	6	14	1.5	15	.116	59.77	2.25	1.39	.83
	BM 3RL	19.2	3	15	1.2	16	.138	59.77	2.40	1.55	.93
	BM 2RL	24	3.5	19.5	1	20.5	.054	46.45	3.08	.47	.22
	BM 1RL	16.3	2	13	1.3	14	.083	46.45	2.10	1.07	.50
	BM 0	16.5	-	14.5	2	15.5	.136	59.77	2.33	1.58	.94
	BM 1LL	16	-	13	3	14	.049	46.45	2.10	.63	.29
2A	BM 1	16.3	2.5	12.5	1.3	13.5	.088	46.45	2.03	1.17	.54
2	BM 3RL	16.6	9	6.6	1	7.6	.028	46.45	1.14	.66	.31
	BM 2RL	17.5	5	10	2.5	11	.296	59.77	1.65	4.84	2.89
	BM 1RL	18.3	2.5	13	2.8	14	.146	59.77	2.10	1.88	1.12
	BM 0	16		15	1	16	.118	59.77	2.40	1.33	.79
	BM 1LL	14.8	3	10	1.8	11	.008	46.45	1.65	.13	.06
	BM 2LL	9.2	3	5.6	.6	6.6	.008	46.45	.99	.22	.10
1	BM 3RL	13.8	4	8.2	1.6	9.5	.048	46.45	1.43	.91	.42
	BM 2RL	14.5	3.5	9.5	1.5	10.5	.193	59.77	1.58	3.30	1.97
	BM 1RL	13.5	3	8	2.5	9.0	.109	59.77	1.35	2.18	1.30
	BM 0	8		4.5	3.5	5.5	.231	59.77	.83	7.51	4.49
	BM 1LL	9.6	2	6	1.6	7.0	.033	46.45	1.05	.85	.39

^{1/} Mining section is considered to represent the gravel and 1 foot of bedrock.

^{2/} When volume of mining section does not represent an average area of 0.3068 ft., the volume is calculated from water measurement of open hole combined with 7-1/2-inch-diameter shoe area for the cased portion of hole.

^{3/} Line 80, hole 28, some drilling below casing - possible salting.

^{4/} Drilled with 4-inch casing and corresponding-size tools.

TABLE 14. - Radiometric analyses of churn-drill
concentrates, Boulder Creek

Line No.	Hole No.	Concentrate, percent eU	Line No.	Hole No.	Concentrate, percent eU
68	24	0.04	88	18A	0.01
	28	.03		20	<.01
				22	.01
74	16	.02		24	<.01
	20	.03		26	.01
	24	.03		28	<.01
	26	.02		30	<.01
	28	.03		32	<.01
	30	.01		34	<.01
	32	.03		36	<.01
	34	.03		38	.02
	36	.02		40	<.01
	38	.04		42	<.01
	42	.03		46	<.01
	44	.02			
	48	.04	94	18	
				22	
80	4	.04		$\frac{1}{24}$	.004
	8	.03		$\frac{1}{26}$	.003
	12	.01		$\frac{1}{28}$	.004
	16	.01		30	<.01
	18	.02		$\frac{1}{32}$	.007
	20	.03		$\frac{1}{34}$	.012
	22	<.01		$\frac{1}{36}$	.021
	24	<.01		$\frac{1}{38}$	.005
	26	<.01		40	
	28			42	.04
	30	<.01		45	
	32A	.01			
	34	.01	100	4	
	36	.01		6	
	38	<.01		8	
	40	<.01		10	
	42	<.01		12	<.01
	44	.01		14	<.01
	46	.01		16	.01
	48	.02		18	
	52	.01		20	
				24	
88	105	.01			
	100	<.01	106	6	.05
	4	.01		8	<.01
	8	.01		10	<.01
	12A	.01		14	
	16	.02			

1/ See table 11 for results of petrographic analyses.

Goodwin Gulch and Goodwin Creek

The Zenda Gold Mining Co. exploration program contemplated drilling on Goodwin Gulch and Goodwin Creek. The company expended its available capital on the exploration of Cape Creek and Boulder Creek; and Goodwin Creek-Goodwin Gulch drilling program had to be abandoned.

The primary aim of the proposed program was to find a buried channel like that on Cape Creek. The alinement of worked-out placer pits in the Goodwin Gulch-Goodwin Creek drainage (fig. 38) suggests that the lode source of placer tin is in the extreme headwaters of Goodwin Gulch. In general, the left limit (north side) of the placer pits in Goodwin Gulch is excavated to solid bedrock, but on the right limit (south side) of the upstream one-third of Goodwin Gulch the edges of the pits and the contours of the bedrock are covered by muck and slide rock. The Zenda churn drilling on East Fork (tributary of Cape Creek) demonstrated the probability that a bedrock channel with an elevation of less than 100 feet extends between Cape Creek and Goodwin Creek. It was thought that a buried channel from the head of Goodwin Gulch might connect with the East Fork-Goodwin Creek channel and might contain a concentration of placer tin; however, here, as on Cape Creek and East Fork, overburden is so heavy that such a channel would have no surface expression. The company planned to drill a line of churn-drill holes across Goodwin Gulch, to be followed by additional drilling if the work indicated the existence of a buried channel.

A secondary objective of the exploration program was to sample the gravels of Goodwin Creek below the mouth of Goodwin Gulch (fig. 38), where previous Bureau of Mines drilling had indicated the existence of a low-grade placer deposit. The company planned to drill at least two lines of holes and, if results warranted, to continue drilling to the limits of the ore deposit.

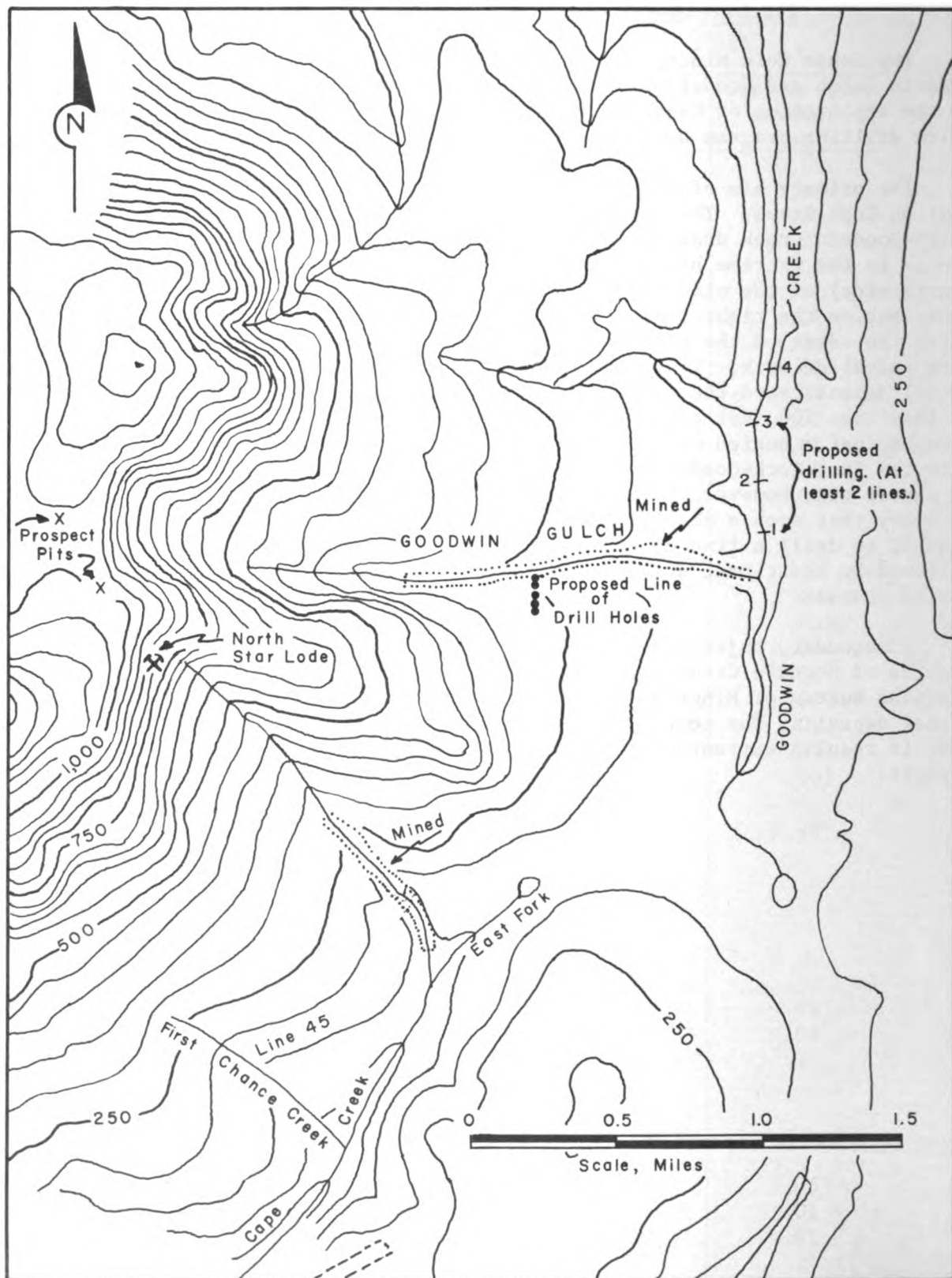


FIGURE 38. - Goodwin Creek and Goodwin Gulch.

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